Exhibit 5

IN RE: NEW YORK COUNTY ASBESTOS CASES	)	CIVIL NO. 190133-12
This Document Applies To:	)	
JOSEPH SALERNO and CAROLYN SALERNO, Plaintiffs, vs.	)	**REPORT AND DECLARATION OF SAMUEL A. FORMAN, M.D.**
AERCO INTERNATIONAL., et al., Defendants.	)	Trial: Not Assigned

REPORT AND DECLARATION OF SAMUEL A. FORMAN, M.D.

I. BACKGROUND

1. I am a medical doctor specializing in preventive medicine and occupational medicine. I received a B.A. degree from the University of Pennsylvania majoring in history and biology, graduating *magna cum laude* in 1973. I attended Cornell Medical School, graduating with an M.D. degree in 1977. I also received a degree in public health in 1977 as a result of a joint program with the Harvard School of Public Health. Thereafter, I became board certified in occupational medicine after attending a residency at the Harvard School of Public Health.

2. From 1973 to 1977, I participated in Ensign 1975, a Navy program that permitted me to engage in active duty service and obtain hands-on training during the summers between medical school sessions. My participation in this program gave me background and experience different from that of many other prospective medical officers at that time, because very few medical officers engage in operational and

administrative rotations as part of their service and training. In the summer of 1974, I engaged in a midshipmen cruise aboard the *USS Shreveport* (LPD-12) for the purpose of obtaining a general understanding of ship operations outside the medical department. I attended training classes and observed activities in all parts of the ship including the engineering department, command information center, commissary department, supply and repair divisions, and aviation division. In the summer of 1975, I did a rotation at the Navy Bureau of Medicine and Surgery ("BUMED"), known at times as the Naval Medical Command. While there, I participated in medical administration in the office overseeing all medical training for the Navy and worked directly with a number of high-ranking officers in BUMED, including William M. McDermott, who at that time held the rank of Captain but who later became Deputy Commander of the Naval Medical Command. During this rotation, I had an extended assignment to analyze Navy expenditures for medical education at civilian universities to ensure the Navy's needs were being met. In the summer of 1976, I did a clinical rotation on the general and internal medicine wards at San Diego Naval Hospital, the largest military hospital in the world. By the time I graduated medical school, I had already accumulated approximately six months of active duty service from my summer internships. These internships gave me a fundamental understanding of the needs of sailors at sea, a general understanding of ship operations, including ship propulsion systems, and insight into the leadership and administrative side of the Navy.

3. In 1977, I graduated from medical school and went on full-time active duty in the Navy. I performed my internship at the Bethesda Naval Medical Center in Bethesda, Maryland during 1977 and 1978. I remained on active duty in the Navy until 1983.

Thereafter, I continued to work for the Navy as a civilian employee until 1986. My qualifications and credentials are more fully described in my curriculum vitae (Exhibit A).

4. Over the course of my active duty service in the Navy, I served aboard Navy ships whose primary purpose was to fulfill national defense missions of the United States. Assignments aboard ship, involving duty at sea, included, in addition to the *Shreveport* in the North Atlantic, *USS Duluth* (LPD-6) in the Eastern Pacific, and *USS St. Louis* (LKA-116) in the Western Pacific. At all times, these ships were performing missions and activities aimed at preparing for or deterring combat. In the military setting, a major goal of training is combat readiness. This training is intended to simulate combat and combat conditions. For example, the Navy hands out "battle efficiency" ribbons to ships that perform well in war exercises. Even combat support ships are required to remain ready to assist ships and sailors on the front line and, at times, these support ships must themselves go into harm's way. To achieve its mission, the Navy had to be willing to put life and limb at risk not just on the front line but also in support operations.

5. One of the highest profile operations in which I was involved occurred aboard the *St. Louis*, which was an amphibious attack transport ship deployed at the time to the Western Pacific for the purpose of carrying Marines, cargo (including heavily armored Marine Corps vehicles used in amphibious assault), equipment and supplies to Navy shore-based facilities. In March 1979, President Carter ordered the Navy to rescue a wave of Vietnamese and Southeast Asian refugees who were escaping communist Vietnam and local pirates into the South China Sea. The *St. Louis* was the first ship of the Seventh Fleet to arrive on the scene. Fortunately the *St. Louis* was able to perform

this mission without exchanging hostile fire; however, in order to perform this humanitarian rescue operation, the *St. Louis* had to travel just outside the twelve mile international limit and sail directly into an area threatened by actively hostile Communist interests. This situation represented an intense Cold War scenario, one of but many types of hazardous scenarios and missions for which the Navy must be prepared.

6. In the course of my active duty service, I also worked in Navy shore facilities, including shipyards such as the Long Beach Naval Shipyard. These facilities contributed to the defense of the country by engaging in industrial efforts to construct, repair and overhaul the Navy's combat and combat support vessels. My role was to ensure that the Navy personnel and civilians involved in these efforts performed their duties as safely as possible.

7. From 1980 to 1982, I ran an occupational health clinic at the Naval Weapons Station at Seal Beach, California, and assisted in the medical programs at the Long Beach Naval Shipyard. Among other responsibilities, I assisted in the asbestos medical surveillance program for over 2,000 federal Civil Service employees and uniformed sailors. At any one time, I was following 200 cases of asbestos disease.

8. In 1982, I was assigned to the Naval Environmental Health Center at Norfolk, Virginia. While stationed there, I designed occupational medicine programs with regard to Navy-specific occupational diseases, performed health hazard evaluations, inspected the occupational health programs of government facilities as part of the Navy Occupational Safety and Health, or "NAVOSH," program, carried out epidemiologic studies, and trained Navy doctors and nurses in occupational medicine.

9. In 1983, a JAG officer for the Naval Medical Command requested that I become part of a team to locate, digest and organize government documents for production in asbestos litigation. Over the next year and a half, I investigated the Navy's historical handling and knowledge of various industrial hygiene issues, including asbestos disease.

10. In 1985, pursuant to Navy orders, I completed my review of Navy knowledge and practice in industrial hygiene, including its awareness of and response to health hazards of asbestos, as a formal assignment. My search for documents took me to the National Archives, other warehouses and storage facilities for records of the Navy's Bureau of Medicine and Surgery. I was given full security clearances for and unimpeded access to these facilities. I also conducted research at private facilities such as Harvard University's Countway Library of Medicine's section for rare books and manuscripts.

11. From my review of countless Navy documents and my studies while employed by the Navy, I acquired extensive knowledge as to the state of Navy knowledge and awareness regarding the hazards of asbestos.

12. Following my research, and with the approval of the U.S. Navy's Bureau of Medicine and Surgery, I published an article entitled "U.S. Navy Shipyard Occupational Medicine Through World War II" in the *Journal of Occupational Medicine*, Vol. 30, No. 1 (Jan. 1988) (Exhibit 1).

13. Though I no longer hold any formal position with the Navy, since I left I have been asked on a number of occasions to speak to Navy medical and safety personnel on issues relating to the history of occupational medicine and industrial hygiene in the Navy.

14. I also am currently a Visiting Scientist in the Department of Environmental Health at the Harvard University School of Public Health.

II. DISCUSSION AND OPINIONS

A. Navy Occupational Health and Industrial Hygiene Organization

15. The Navy has always taken responsibility for the health and safety of its uniformed and civilian personnel. It has consistently exercised its discretion regarding hazard recognition and appropriate controls in Navy workplaces. As Navy Captain Ernest W. Brown, M.D., recognized as the architect of the Navy's formal occupational health program prior to World War II, wrote in 1940: "One of the most important concerns of the Medical Department of the United States Navy today is industrial hygiene, especially in navy yard practice." (Exhibit 2).

16. This commitment was reflected in numerous other Navy statements and documents. In 1943, Secretary of the Navy, Frank Knox, in a statement co-signed by the Chairman of the U.S. Maritime Commission, E. S. Lamb accompanying "Minimum Requirements for Safety and Industrial Health in Contract Shipyards," stressed the Navy's commitment in this regard:

> The necessity for conserving manpower and promoting the physical welfare, health, and safety of what shortly will amount to one million workers in shipyards required that careful observance of standards for the prevention of accidents and protection of health be accorded. Aside from the weight which must be given humanitarian consideration, it is simply good common sense that as much care and attention be given to protecting the human factors in the war production program as is given machines.

(Exhibit 3). Similarly, in a 1955 Naval Institute publication called *The Human Machine*, Captain Charles W. Shilling of the Navy Medical Corps described the "paramount importance" of Navy health: "[T]he medical component of the Navy has a heavy responsibility" with a mission to promote physical fitness, prevent and control diseases and injuries and treat and care for the sick and injured. (Exhibit 4).

17. While the formal titles have varied over the years, the most senior Medical Corps officer in the Navy is the Navy Surgeon General, who is also the Chief of BUMED and who reports to the Chief of Naval Operations ("CNO"). The Navy Surgeon General has responsibility to spell out health programs, including prevention and injury care, for sailors and civilian workers (as appropriate). Medical Corps, allied health professions and enlisted hospital corpsmen are responsible for advising operational line commands to carry out preventive practices and to provide specialized industrial hygiene services. It is the responsibility of the Navy line authorities (the operational chain of command) to carry out these recommendations.

18. Given the breadth and sophistication of its military and industrial activities, the Navy recognized the need to establish departments and bureaus with specific expertise in scientific and technical areas of importance. The Navy Medical Department (which encompasses BUMED, among other organizations)

> is actively concerned with all phases of life in the Navy and advises all components of the Navy on matters which may affect the health and well-being of naval personnel. . . . There is a Medical School, a Dental School, and a Medical Research Institute at the National Naval Medical Center, Bethesda, Maryland. There are also numerous other research units established in connection with operational activities throughout the world. . . . [T]he Medical Department and all of its component parts are working with the operational forces of the Navy, in all areas of naval importance.

(Exhibit 4 at 275 and 276).

19. In addition to monitoring all health programs including industrial hygiene in both a quantitative and qualitative way, the Navy's Medical Department also originated extensive research activities:

> As it is with other component parts of the Navy, research is an intimate part of the Medical Department activity, the importance of which cannot be overemphasized. Through research we assist in the development of new equipment, new and better methods of care and treatment of various diseases and injuries; help in the problem of adjustment of naval personnel to all of the new and strange environmental situations in which they are placed; and, in general, provide the knowledge necessary for more efficient operation of the Navy.
>
> Research under the cognizance of the Bureau of Medicine and Surgery is accomplished in a large medical research institute, in several research laboratories, fleet and shore-based units, and in various naval hospitals. The scope of this research is extremely broad and parallels the total activity of the Navy.

(Exhibit 4 at 277).

20. A 1956 Navy training document entitled "Naval Orientation" described the scope of BUMED's responsibilities:

> The Bureau of Medicine and Surgery is responsible for safeguarding the health of personnel of the Navy; the procurement of all medical and dental materials; research in medicine and dentistry; evaluation of the performance characteristics, from the physiological standpoint, of equipment designed for the use in naval service; the determination of standards of sanitation and hygiene; the professional education and training of medical personnel; and the establishment of professional medical and dental standards for clinical methods and procedures.

(Exhibit 5 at 177).

21. Among the tasks of BUMED in connection with its research and monitoring activities was the distillation of the results of that experience into practical guidance for the rest of the Navy. The translation of the results of that experience into practices and procedures for Navy personnel, and the communication of those practices and

procedures, necessarily involved the exercise of judgment by BUMED in determining what topics, and what specific information on those topics, should be disseminated to Navy personnel. Personnel recipients included officers, enlisted, civil servants and contractors. The communication of such information was designed to ensure that recipients received precisely, and only, what was deemed appropriate in light of their duties and responsibilities, and the overall mission and operations of the Navy.

22. As a consequence of the Navy's approach to such matters, the knowledge of any individual Navy sailor – even an officer with command responsibilities – with respect to an issue like the hazards of asbestos cannot be taken as representative of the broader knowledge of the Navy on the topic. By design, that individual would have possessed only that knowledge necessary, in the view of BUMED, to the performance of his or her duties. Put differently, regarding asbestos – as with many other health and safety issues – there was extensive information regarding potential hazards and potential protective measures that were consciously not shared with the vast majority of Navy personnel who were deemed not to have a need to know.

23. As a General Medical Officer, I was not permitted to deviate from the standardized programs developed by the Navy Surgeon General for the health of Navy personnel, without approval from a more senior Navy officer except in extraordinary circumstances, such as if a ship was isolated or out of contact with more senior, knowledgeable and experienced officers.

24. All Navy personnel including medical officers must follow their chain of command to maintain good order and discipline. Enlisted personnel are indoctrinated during boot camp and training with the understanding that they must conduct all activities

"the Navy way," meaning that Navy orders and instructions supersede any information or directions received from any source outside the Navy. Sailors must follow orders trusting that their chain of command will have the mission of the Navy in mind and will address safety as best as possible. Unlike in the civilian community, all military personnel who refuse to perform an order could be subject to various penalties pursuant to the Uniform Code of Military Justice ("UCMJ"). Absent extraordinary circumstances, the Navy demands and enforces rigid adherence to the chain of command. It does so because it is the military's method for institutionalizing strategic considerations, highly specialized expertise, and prior experience and then transforming this information in an effective and predictable way into programs and orders for all personnel to follow.

25. Collective and uniform communication and implementation of Navy programs and orders are key to the Navy's operational flexibility. The Navy has numerous sailors with specialized capabilities. The Navy also maintains many ships and multiple shipyards with specialized capabilities. The Navy strives to ensure that each sailor is consistently trained, and that each ship in its fleet is predictably constructed so that it can rely on both the sailors and the ships to perform critical operations without endangering sailors any more than is necessary to achieve mission success.

B. Navy Knowledge of Asbestos-Related Health Issues

26. Consistent with the Navy's interpretation of the importance of industrial hygiene and occupational health, the Navy's programs in these areas have paralleled, and at times led, the development of occupational medicine and industrial hygiene in general, and asbestos-related issues in particular. The Navy's knowledge in the areas of asbestos and associated health conditions has been quite complete when compared to available

knowledge over time, and at least by the early 1940s, the Navy had become a leader in the field of occupational medicine relating to, among other things, asbestos dust inhalation exposure.

27. As early as 1922, the Navy recognized, as exemplified by its instructions to officers published in the *Navy Medical Bulletin*, the health hazards associated with airborne asbestos dust and the appropriate protective measures to prevent asbestos exposure. These included the use of water to dampen dust, exhaust systems to remove dust, enclosed chambers to prevent escape of dust and respirators. (Exhibit 6). The Navy's knowledge of potential asbestos-related health problems, and of the means to control against them, continued to expand throughout the following decades, as senior Navy officers actively assessed, evaluated, controlled, and made recommendations concerning Navy policy regarding disease and injury prevention, including asbestos related occupational health hazards.

28. The Navy's health and safety apparatus on the eve of World War II was described in the 1939 Handbook of the Navy Hospital Corps published by the Bureau of Medicine and Surgery under the direction of the Secretary of the Navy:

> The United State Navy is one of the largest of the industries maintained by this Government. An organization has been set up in the Navy to protect its personnel, both civilian and naval. A safety engineer is provided, who acts directly under the Assistant Secretary of the Navy. He has supervision of the safety precautions taken to protect the civilian employees in the navy yards, ammunition depots, torpedo stations and the like. He is also a consultant in all matters pertaining to safety aboard ships, at training stations and other Navy Department activities. A naval medical officer is assigned to his office for the purpose of consultation in all matters pertaining to health and safety and to cooperate in devising means by which health may be protected and accidents prevented. Aside from this particular medical officer, all medical officers, dental officers, members of the Hospital Corps and nurses form the balance of the medical staff of this organization. It is essential that each one of these members

> know and understand the hazards to be encountered in the Navy, the steps to be taken to protect against injury and disease, the treatment of diseases and injuries arising therefrom and the organization of the medical personnel for such purposes. Naval medical personnel are required to perform duties ashore, at sea, in foreign countries, in the air and under the sea. In each of these places a variety of health hazards exist. It is therefore necessary that this [sic] personnel have a thorough knowledge of the industry to which they are attached, the hazards presented, the methods of prevention and the treatment of all injuries occurring.

(Exhibit 7).

29. The Handbook of the Navy Hospital Corps also explained that all Navy yards have a commandant who "is responsible to the Navy Department for the protection of employees, as well as Navy personnel, under his command. He is familiar with . . . the health and accident hazards presented." Thus, the Commandant was "responsible for the appointment of the safety engineers [who will] make inspections and recommend proper protective measures." The Handbook further called for the Navy medical officer to "advise the safety engineer and instruct the employees in safety measures and encourage them to cooperate in protective measures." These safety measures included required "masks for asbestos workers."

30. Also in 1939, the Annual Report of the Surgeon General of the Navy addressed the "Hazard of Asbestos," and described asbestosis as "an industrial disease of the lungs incident to inhalation of asbestos dust for prolonged periods." The Report noted the risk from "continued exposure to present occupational conditions" at Navy facilities, and directed appropriate methods for preventing such exposures, recommending the use of local exhaust ventilation to control asbestos dust exposure for insulators in the fabrication shop. (Exhibit 7).

31. At about the same time, Navy Captain E.W. Brown undertook an assessment of asbestos exposure, and its prevention, in Navy yards. In an article entitled "Industrial Hygiene and the Navy in National Defense" published in 1941, Captain Brown prescribed appropriate measures for the prevention of asbestos exposure. These included use of respirators, local exhaust ventilation, and wetting of asbestos containing materials. (Exhibit 2).

32. The Navy has historically directed all aspects of policy and procedure addressing the health and safety of Navy personnel. This direction has encompassed policies, practices and procedures to protect workers from dangers posed by exposure to asbestos. Indeed, the Navy has on several occasions over time rejected offers of assistance from other leaders in the field.

33. For example, in 1941, the U.S. Labor Department's Bureau of Labor Standards offered to conduct inspections of health and safety conditions in Navy shipyards. Navy leaders rejected this offer. In a memorandum to Navy Surgeon General McIntire, Commander Charles S. Stephenson, head of the Division of Preventive Medicine within the Navy's Bureau of Medicine and Surgery, offered "[n]otes for consideration when you call on Assistant Secretary [of the Navy Ralph A.] Bard." Commander Stephenson advised Admiral McIntire that Assistant Secretary Bard

> asks specifically what the policy is concerning invitation of...the Bureau of Labor Standards, Labor Department into the Navy Yards to make a survey of the welding and other hazards. I told him that we had never done that sort of work and recommended against it, as I know who [the Bureau of Labor Standards] intends to send if it should be done.

Navy leaders recognized that other government departments had a high level of expertise, while rejecting the offers of assistance:

> I gave Mr. Bard and the two officers present a complete story of the beginning of this controversy from the Federal Administrator's letter: that is, that the United States Public Health Service had four teams of traveling scientists alleged to be able to make surveys of all of the Navy Yards and make recommendations for the correction of such hazards as were discovered.

He then emphasized:

> I told Mr. Bard that this was not considered the best policy, due to the fact that we had medical officers in the Yards and that in practically all instances recommendations of sound character had been made by medical officers. We saw no need of inviting the United States Public Health Service on its own invitation to do this job.

(Exhibit 9).

34. The Navy's reluctance to accept these offers of assistance was based on concerns regarding possible upset of labor relations, and also for security at Navy facilities. Stephenson's memorandum makes clear that these concerns originated at the highest levels of Government:

> Likewise, I told him that I had spoken to you and that you had indicated that President Roosevelt thought that this might not be the best policy, due to the fact that they might cause disturbance in the labor element.

(President Roosevelt was familiar with the structure and operation of the Navy's shipyards and other facilities – and in particular with the functioning of the Navy during wartime – from his tenure as Assistant Secretary of the Navy from 1913 until 1920. Admiral McIntire was President Roosevelt's personal physician in addition to being the Surgeon General of the Navy.)

35. Stephenson's positions were taken even in light of knowledge that not all industrial hazards were adequately controlled at Navy facilities: "I doubt if any of our foundries would be tolerated if the State industrial health people were to make surveys of

them." Asbestos, too, was discussed as an issue: "I am certain that we are not protecting the men as we should."

36. Health and safety issues, including those relating to asbestos exposure, continued to be a major focus of the Navy and the United States Maritime Commission throughout World War II. In 1943, the Navy, along with the Maritime Commission declared its responsibility for the safety and health of their workers and took charge of implementing and staffing safety and health programs for those workers. Following extensive discussion with various constituencies, the Navy and the Maritime Commission jointly issued "Minimum Requirements for Safety and Industrial Health in Contract Shipyards" ("Minimum Requirements"). (Exhibit 3). The specific requirements imposed by the document enunciated for private and contract shipyards expectations that were already in effect and implemented at the Navy's own facilities.

37. The Minimum Requirements identified asbestos-related disease as a potential hazard of shipyard work, explaining that exposure could result from handling, sawing, cutting, molding and welding rod salvage around asbestos or asbestos mixtures. The document advised that such jobs "can be done safely with:

1. Segregation of dusty work and,

2. (a) Special ventilation: Hoods enclosing the working process and having linear air velocities at all openings of 100 feet per minute, or

(b) Wearing of special respirators.

3. Periodic medical examination."

The Minimum Requirements also warn that jobs involving exposure to asbestos require "respiratory protective equipment," in particular a "dust respirator." A ventilation supervisor (the safety engineer) was required to be trained to handle the entire ventilation

program in the yard, which was to include classes, demonstrations and short talks on proper procedures.

38. The Minimum Requirements further called for employee safety training: "the time for the safety training of an employee to start is at the inception of his employment." "Employees shall have in their possession, and be instructed in the proper use of, all necessary personal protective equipment before being started on any job." Safety bulletin boards were to be located at each hull and shop, with "[s]afety posters and other material on the bulletin boards" changed at least semi-monthly. The type of safety posters used in these worker educational campaigns included materials reinforcing the use of masks for protection against disease-causing dusts. One such poster stated, "His mask keeps him on the job." (Exhibit 10).

39. This commitment by the Navy to address the asbestos-related health concerns of Navy workers, as set forth in the 1939 Handbook of the Hospital Corps and the Minimum Requirements document, is further evidenced by dozens of other documents generated by the Navy and consultants it retained during the war years.

40. Later in the war, following extensive study of asbestos-related health issues, Dr. Philip Drinker, a Harvard professor and Chief Health Consultant to the Division of Shipyard Labor Relations and consultant to the Navy Surgeon General since 1941, wrote on January 31, 1945 to Captain Thomas J. Carter at the Navy's Bureau of Medicine and Surgery. In his letter, he reported on analyses of airborne dust collected at Bath Iron Works, a leading contractor for construction of Navy vessels. Dr. Drinker summarized the results of the analysis: "This evidence is enough to indicate a fairly serious dust risk at Bath and to make it very probable that the same sort of thing will be found in other

plants and yards where the same type of [asbestos] pipe covering materials are used." (Exhibit 11).

41. In addition to asbestos health concerns revealed at Bath Iron Works, experience in some of the contract shipyards also came to the attention of Dr. Drinker and Navy authorities:

> I suggested to Admiral Mills that it would be very desirable for Navy to examine men handling the preparation of [asbestos] pipe coverings and their installation in at least two Navy Yards and two Navy contract yards as this is much more a Navy than a Maritime problem because the materials are used especially on Navy vessels with high pressure steam power plants. Admiral Mills agreed that such studies would be wise before Navy or Maritime accepted this asbestos risk as being significant in our general ship construction program.

(Exhibit 11).

42. Dr. Drinker and his Navy colleagues published the results of the study he had suggested in W.E. Fleischer, et al., "A Health Survey of Pipe Covering Operations in Constructing Naval Vessels," 28 *Journal of Industrial Hygiene & Toxicology* 9-16 (Jan. 1946). (Exhibit 12). The study reaffirmed the Navy's position regarding acceptable occupational dust exposure levels and dust control strategies. They offered the conclusion that "[asbestos] pipe covering is not a dangerous trade."

43. The conclusions of this study were carried into practice in Navy workplaces following World War II. The January 1947 issue of the Navy's *Safety Review* publication noted that "[e]xposure to asbestos dust is a health hazard which cannot be overlooked in maintaining an effective industrial hygiene program." (Exhibit 13).

44. Also during the second half of the 1940s, the American Conference of Governmental Industrial Hygienists ("ACGIH") evaluated the issue of asbestos exposures. This entity, comprised entirely of industrial hygienists with links to the

government and academia, published threshold limit values for acceptable exposures to asbestos dust in the workplace. These standards were periodically updated over the years. Representatives of the Navy, trained as industrial hygienists, participated in the ACGIH. In recognition of the potential hazards associated with exposure to asbestos dust, a 1955 Navy Bureau of Medicine instruction adopted the ACGIH's threshold limit value for exposure to asbestos dust among Navy personnel. (Exhibit 14). The 1955 threshold limit value as promulgated in the Navy instruction was the same level to which the Navy had sought to control exposures during World War II.

45. During the 1950s, the Navy continued to prescribe safe work practices to address potential shipyard hazards associated with exposure to asbestos dust. For example, a 1950 General Safety Rules Manual issued by the Puget Sound Naval Shipyard instructed workers to "[w]ear dust type or air-fed respirators for . . . handling amosite [asbestos] insulating materials. . . ." (Exhibit 15).

46. In 1957, the Navy convened at the Boston Naval Shipyard a "Pipe and Copper Shop Master Mechanics' Conference" to address issues of concerns to those in the pipefitters' trade. At the conference were personnel from all twelve Navy shipyards and the Navy's Bureau of Ships in Washington, D.C.

47. The prepared remarks of a Long Beach Naval Shipyard official, included in the Minutes of the Conference reflect the Navy's stated policy that pipe insulators and laggers who handle asbestos products should wear respirators:

> Asbestos, when handled dry, produces vast amounts of silica dust. . . . [T]he material can be dampened to reduce the amount of dust liberated. However, the specified type of amosite [asbestos] for use on cold water piping is water repellent. Also material which must be removed from an existing installation is dry and powdery, being an excellent dust producer. . . .

> [D]uring 1956 eleven deaths from asbestosis were reported on the Pacific Coast alone. . . .
>
> I know that two of my insulators are now afflicted with this condition. How many more will become afflicted is something which I hesitate to predict.
>
> Again the solution is obvious. Remove the cause by substituting other products. . .
>
> In the meantime, the answer is the wearing of respirators by all who handle asbestos products.

(Exhibit 16).

48. A New York Naval Shipyard official added that if those working with asbestos insulation have not been "told . . . to put on masks, you are more or less the cause of their trouble." That same official added:

> I think everyone, who has people doing this type work, should warn their people regarding the handling of this material. With the proper handling of it on the job, and it has always posed a very big problem, because the men don't want to wear the masks, or get this dread disease. It is difficult to protect them. After a couple of years of mandatory wearing masks, I think they should realize the danger. I think everyone ought to enforce the wearing of masks. Don't forget this is something that injures people's health. We should do something about it – and fast, and I am convinced that what we are doing is not enough. We should not have people handle this material withou[t] protection.

49. On January 7, 1958, the Department of the Navy issued a "Safety Handbook for Pipefitters," which explicitly addressed the asbestos hazard and again set forth Navy policy for controlling this hazard. (Exhibit 17). This handbook – one of many safety handbooks issued by the Navy – stressed that "[a]sbestos dust is injurious if inhaled," and warned those working with asbestos insulation materials to "[w]ear an approved dust respirator for protection against this hazard."

50. The early 1960s brought still further development of the Navy's policies and practices to protect workers from asbestos-related health concerns. For example, Captain H.M. Robbins, a Navy physician, and W.T. Marr, a Navy industrial hygienist from the Long Beach Naval Shipyard, published the article entitled "Asbestosis" in the October 1962 issue of the Navy's internal *Safety Review* publication. The article addressed the potential for exposure to asbestos aboard ships:

> Aboard ship, a great variety of insulation is performed. Insulation blocks are shaped with a saw, pads are supplied to fittings, insulation cement is applied to blocks and covered with asbestos cloth. These and other operations take place in nearly all compartments; however, most work is done in the machinery spaces. By far the greatest potential exposure to asbestos fibers occurs during ripout of old insulation for ship overhaul or reconversions.

The article concluded that "[t]he worker's best protection is to avoid careless creation of dusty conditions, use damp material when possible, and wear respiratory protection constantly." (Exhibit 18).

51. In 1968, the Navy came under scrutiny for its handling of asbestos-related health issues. On July 30, 1968, Murray C. Brown, Medical Director of the Public Health Service, wrote to Vice-Admiral R.B. Brown, the Chief of the Navy's Bureau of Medicine and Surgery, stating that "[o]ne of our grantees, Dr. Irving Selikoff of New York University, has recently completed a study of non-insulation shipyard workers' exposure to asbestos," and that "Dr. Selikoff reports he has some interesting data and has requested that we arrange an information meeting with your Department and the U.S. Department of Labor to discuss his findings." (Exhibit 19). On December 5 of that same year, Admiral Brown reported to others in the Navy health establishment that "Doctor I.J. Selikoff of Mount Sinai Hospital, through the news media, stated that he has warned the

Navy and other Federal departments of his findings relating to the unusual incidence of asbestosis among shipyard asbestos workers. The newspaper articles stated that the Federal agencies including the Navy have not publicized the hazards." (Exhibit 20).

52. In a "Hazard Analysis" commissioned in response to this external criticism of the Navy's safety practices, Commander Rosenwinkel of the Navy's Bureau of Medicine assured that:

> [T]he Navy's shipyards have for many years been aware of the hazards of asbestos and have initiated appropriate safety precautions. Insofar as possible, all fabrication work [with insulation] is performed in the shops where adequate safety precautions can be observed. These precautions include controlled ventilation, use of respirators, and wetting down of the material. During "rip out" operations, respirators are worn and ventilation is controlled as far as possible.

Similar language was prepared "for inclusion in a statement to be issued by Rear Admiral J.J. Stilwell, Shipyard Management Directorate":

> The United States Navy is well aware of the hazards of asbestos to its employees engaged in ship construction and ship repair at naval shipyards. Hazard control measures implemented by the shipyard medical departments and practices are in accordance with accepted standards of industrial hygiene practices in the United States. Stringent efforts are directed at keeping the concentration of air borne asbestos dust below the level recommended by the American Conference of Governmental Industrial Hygienists. An energetic periodic physical examination program insures the health of personnel exposed to this hazard.
>
> For more than two years, the Naval Ship Systems Command and the Commander of Boston Naval Shipyard have been cooperating with a prominent investigator in a study whose ultimate goal is to define safe working conditions with respect to air borne asbestos. Upon the development of further objective, well founded recommendations for the control of this hazard, the Naval Ship Systems Command, in cooperation with the Bureau of Medicine and Surgery, will take the necessary steps to implement them at the naval shipyards and all naval activities.

(Exhibit 21). The message was clear, and consistent: the Navy would handle asbestos issues in its own way and through its own channels.

53. The development of the Navy's policy towards asbestos-related health issues, and of its program for addressing asbestos exposure to Navy personnel, continued into the 1970s. On February 9, 1971, the Commander of the Navy's Ship Systems Command issued to numerous Navy bureaus and commands its Instruction 5100.26. That document began by recognizing that:

> [t]he most critical use of asbestos in the Navy from a safety viewpoint is in the fabrication, installation, repair or removal of pipe and boiler insulation materials. Some workers sustain accidental contacts either while employed in various capacities where asbestos products are processed or when working in plant areas in which an environmental pollution of the air exists due to asbestos.

In light of these concerns, the purpose of the document was "to prescribe appropriate safety precautions during the use of asbestos," and it decreed that:

> [t]he following safety precautions will be observed by all supervisors and workers engaged in the fabrication, installation and/or removal (ripout) of asbestos-containing insulation material. The provisions of this instruction will be effective as of this date. The provisions in this instruction are considered as minimum health and safety requirements. More stringent restrictions may be applied by local commanders.

The document then listed nearly fifty specific work practices to be employed to protect workers from asbestos exposure in handling or working in the vicinity of asbestos-containing products. (Exhibit 22).

54. The Navy was committed to maintaining complete control over existing military specifications, policies and procedures with respect to asbestos-containing materials and worker practices with those materials. The Navy maintained a fierce autonomy over hazard recognition and control, because the Navy considered itself the ultimate authority on naval systems and military workplaces. Regardless of the source of

other information, the Navy viewed its unique knowledge as a strategic advantage in addressing hazard identification and control in its workplaces.

55. In the effort to achieve its mission, the Navy made trade-offs between the use of asbestos and the potential health impact on personnel. In the Navy's judgment, the beneficial aspects of asbestos from an engineering standpoint (technical performance, cost, weight, etc.) made it the best thermal insulation available and a critical war material. As knowledge of asbestos health risks evolved, the Navy made sensitive military mission-related decisions about deriving the benefits of asbestos while controlling its risks. Moreover, when the hazards of asbestos became more fully known to the Navy and the scientific community in the late 1960s, the Navy determined not to do an immediate fleet-wide elimination of asbestos. At the time, Navy leaders were concerned that a large scale, immediate asbestos removal program would pose at least three problems: excessive cost; mission impairment; and increased health hazards to removal crews from disturbing fixed, in-place asbestos.

56. The Navy asserted for itself the role as final arbiter of what was best with respect to industrial hygiene in its unique workplaces to carry out its national defense mission. The Navy's reasons for this approach include: harmonizing industrial hygiene with its overall operations; maintaining security of its facilities; and unifying communications to its workers.

57. The Navy rejected participation from manufacturers in its efforts to alert its personnel to potential asbestos hazards in Navy operations. The Navy pursued the issue in its own way. Professor Drinker recorded:

> I met with the manufacturers of the materials used at Bath and they stated they would be glad to get out a brief statement of precautions which

> should be taken in the light of their own experience and that they would inform their competitors that I had asked them to do so. I understand that neither Navy nor Maritime wants any change in the specifications as the performance with the present materials is entirely satisfactory. From a health standpoint we do not believe any specification changes are needed.

(Exhibit 11.)

58. BUMED, through a litany of instructions, bulletins and other communications, developed work practices and procedures designed to take what BUMED deemed to be appropriate precautions against workplace and environmental hazards to Navy personnel.

59. Not surprisingly, in my research, I have not located a single instance in which the Navy, at any time during the 1930s through the 1960s, instructed or permitted a supplier of engineering equipment to a vessel or facility to affix or provide any asbestos-related warning with its equipment. The Navy has not depended on equipment warnings in its workplaces concerning long-term occupational health issues. Rather than depending on equipment signage or labeling, the Navy put its efforts into work practice training, specifications for materials being used in its unique workplaces, and the hierarchy of industrial hygiene controls.

60. The Navy's approach to the protection of its personnel from health hazards – and the lack of a role for equipment manufacturers in that process – is exemplified by the Uniform Labeling Program, SECNAV [Secretary of the Navy] Instruction 6260.3. (Exhibit 23).

61. The Uniform Labeling Program had as its stated purpose "to standardize on [sic] labeling requirements for hazardous chemical products. . . ." (Exhibit 23). It did not not require any actions of parties outside of the Navy, including manufacturers of

equipment. It is also clear that the Navy's Uniform Labeling Program was strictly an internal document. In other words, the program was designed by the Navy, for implementation by the Navy. It was not intended as a set of requirements governing the activities of outside parties. The Uniform Labeling Program is an internal Navy program whose addressees are Navy Commands: "Scope: The instruction applies to the labeling of all hazardous materials throughout the Naval Establishment wherever distribution of hazardous chemical and materials is made to the actual consumer (shop, office, or unit)"

62. The internal nature of the Uniform Labeling Program is evident from its provisions:

(a) The Navy Department Standardization Office was directed to assign a Navy project to "standardize the printed labels in respect to quality of paper, size, color, shape, insignia, wording, and design; quality of the glue; specifications for inks including colors of inks); and other related matters." (Exhibit 23 at 4.a.);

(b) The Navy's Bureau of Supplies and Accounts was directed to "initiate procedures to have the necessary labels stocked as General Store items for use by all naval activities." (Exhibit 23 at 4.b.);

(c) Classification of hazardous chemicals was to "be accomplished through the joint efforts of the technical bureaus in that each Bureau shall be responsible for passing on those aspects, of any single item, which fall within its technical purview." (Exhibit 23 at 4.c.).

(d) The document listed the responsibilities of a Navy Safety Precautions Board, and of Navy bureaus and offices, and of the Marine Corps, in implementing the program. (Exhibit 23 at 4.d & 4.e.).

63. The Uniform Labeling Program expressly states that it does not impose any requirements on manufacturers of products. Consistent with its focus on chemical materials and substances, the document makes reference to container labeling that may be necessary for intrastate or interstate shipping, and to labeling by "manufacturers of chemicals" in accordance with Manufacturing Chemists' Association guidelines. (Exhibit 23 at 2.a.).

64. The Uniform Labeling Program was prompted by "[t]he rapid development of new chemical products and the introduction of new chemical processes," and by the Navy's view that "[w]arning labels affixed to containers of hazardous chemicals are one of the most practical means of accomplishing th[e] objective" of ensuring that Navy personnel take "precautionary measures . . . during the handling of toxic and dangerous chemicals." (Exhibit 23 at 3).

65. Throughout the SECNAV Instruction describing the Uniform Labeling Program, the focus is on chemical products, and on the appropriate labeling for containers of chemical products. The document includes as an enclosure an alphabetical listing of materials it covers, all of which are toxic chemicals or materials. There is no mention of or suggestion that the program has any applicability to equipment such as pumps or valves, or to products such as gaskets or packing, or does the Uniform Labeling Program anywhere mention asbestos.

66. The documents referenced in the Uniform Labeling Program also refer to labeling of containers of hazardous chemicals. For instance, there is reference to the Manufacturing Chemists' Association's Manual L1, "A Guide for the Preparation of Warning Labels for Hazardous Chemicals." (Exhibit 24). Like the Uniform Labeling Program itself, Manual L1 expressly states that it is intended to provide information to "every person using, handling or storing *chemicals*." It expresses the view that "[t]he most practical means" of disseminating such information is "by warnings affixed to containers of hazardous *chemicals*." (Exhibit 24 at 5 (emphasis supplied)). There is nothing in the document to suggest that it relates to instructional or other documentation accompanying machinery or equipment, or that it relates to finished products such as gaskets or packing.

67. That the Uniform Labeling Program imposed neither internally within the Navy nor on manufacturers of machinery or equipment any responsibility for labeling of asbestos-containing materials is belied by the Navy's own implementation of the program is exemplified by a January 15, 1960 Occupational Hazards Release (Exhibit 25) summarizing significant information on occupational health and industrial hygiene from through the Navy and distributed by the Chief of the Navy's Bureau of Medicine and Surgery. The document reported on the review by a Navy shipyard of new products "[i]n accordance with SECNAV Instruction 6260.3 and BUSHIPS Instruction 6260.3 on labelling toxic materials." With respect to "Hy-Temp Block Insulation," an insulating material containing 12-15% asbestos, the Navy concluded as follows: "No label." The fact that the Navy determined that no hazard label was appropriate for an asbestos-containing insulation material of the type whose hazards it had been aware of and

discussing since the 1920s is inconsistent with the notion that the Navy sought, or would have accepted, asbestos-related warnings affixed to equipment or machinery or in technical documentation relating to such items.

68. The Navy's 1969 Consolidated Hazardous Item List, NAVSUP Publication 4500 (Exhibit 26) issued more than a decade later, had the same focus and purpose as the Uniform Labeling Program. The document expressly governed the labeling of "containers," and it states that the purpose of labeling it requires is "to warn users of the potential dangers involving the use of the material in the container." (Exhibit 26 at VIII). There was no suggestion that the document applied to equipment or its manufacturers. Like the Uniform Labeling Program, the Consolidated Hazardous Item List is an internal Navy document, describing procedures intended to be implemented by the Navy.

69. Nor were military specifications among the means by which the Navy sought to protect its personnel against long-term health issues such as asbestos exposure. Rather, protection against such hazards was undertaken, through the Navy's Bureau of Medicine & Surgery, through a comprehensive system aimed at identifying evaluating potential threats to the long-term well-being of Navy personnel and developing appropriate training and procedures to mitigate those threats. While military specifications were outward looking – directed to vendors outside the Navy – development and implementation of protective measures regarding asbestos was viewed as an internal Navy issue.

70. The language in military specifications governing technical manuals for equipment is consistent with my overall experience that the Navy did not view manufacturer labeling or warning as an important, or in many instances an appropriate,

means of protecting against exposure to ubiquitous, well-known, long-term potential health hazards such as asbestos. For example, MIL-M-15071D, dated June 6, 1961 and governing "Manual, Service (Instruction Books) for Shipboard Electrical and Mechanical Equipment" stated that use of cautionary language "should be as sparing as is consistent with real need." (Exhibit 27 at para. 3.3.6).

71. Consistent with my experience that the Navy saw little value, and much potential for confusion, in extensive use of caution labels addressing common hazards or conditions, particularly when no threat of immediate injury or harm to individuals or equipment was present, the Navy's directed that warnings in technical manuals be "sparing." Rather than depending on equipment signage or labeling, the Navy put its efforts into work practice training, specifications for materials being used in its unique workplaces, and the hierarchy of industrial hygiene controls.

72. The kinds of warnings the Navy did permit in equipment technical manuals underscore that the Navy's focus in this regard was on immediate hazards to life and equipment operation as being appropriate for inclusion in equipment manuals. Such warnings were related to materials that presented immediate hazards to life and equipment, including, for example, solvents which have long been recognized as material that present both inhalation and flammability hazards. Both of these hazards can, of course, result in immediate, severe injury or damage.

73. Similarly, carbon tetrachloride which, while a solvent, is not flammable, is hazardous based in part on its potential to break down and release toxic phosgene gas at elevated temperatures. The release of phosgene gas, which was used as a chemical weapon during World War I, presents a risk to users or others in the vicinity of poisoning.

74. The potential for immediate injury due to inhalation or explosion presented by solvents presents a hazard fundamentally different from the type of disease risk that the Navy has long known to be associated with exposure to asbestos.

75. An acute injury or accident hazard of the type associated with solvents is a type of "safety" risk long viewed by the Navy as the responsibility of safety officer and the line command. By contrast, asbestos presents a long-term, environment threat to "health" of personnel. The Navy has traditionally handled such health risks under the technical purview of the medical department. The fundamental distinction between safety and industrial health is evident, for example, from the "Minimum Requirements for Safety and Industrial Health in Contract Shipyards" (Exhibit 3), which present separately "Minimum Requirements for Industrial Health" and "Minimum Requirements for Safety."

76. As a consequence, the fact that the Navy permitted, or perhaps required, warnings regarding solvents in some equipment technical manuals does not mean that the Navy likewise wanted, or would have permitted, asbestos-related cautionary language in those documents during the period in question.

B. Gaskets and Packing

77. With specific reference to potential hazards associated with the handling of asbestos-containing gaskets and packing, I am aware from my research and from my personal experience in the Navy that these materials were regarded as negligible sources of asbestos exposure. For example, a December 9, 1968 U.S. Department of the Navy Memorandum regarding "Hazards of Asbestos" stated that

> [a]ll of the asbestos in [gasket and packing materials] is fabricated as cloth, rope or compressed sheet with binders, so that the items are not friable when they are cut. Thus, these items do not cause dust in shipboard applications. In addition, in many instances, they are received already incorporated in the finished assembly such as a valve, and do not require fabrication by the shipyard. For these reasons, packings and gaskets containing asbestos are not considered to be a significant health hazard.

(Exhibit 21).

78. This conclusion was reaffirmed in the published literature by P.G. Harries, who made extensive study of asbestos exposure in shipyards in the United Kingdom. In "Asbestos Dust Concentrations in Ship Repairing: A Practical Approach to Improving Asbestos Hygiene in Naval Dockyards," *Ann Occup Hyg 14*: 241-254 (1971), Harries concluded that asbestos-containing gaskets, which he referred to as "high temperature jointing and packing materials," presented "[n]o health hazard in forms used in shipyard applications." He also noted that "[n]o substitute heat-resistant material is available" for asbestos in these applications. (Exhibit 28).

79. A 1973 publication of the International Agency for Research on Cancer – *Biological Effects of Asbestos* – stated that "[t]here is no conceivable health risk in the use of asbestos-based gasket materials." (Exhibit 29 at p. 325). Well-known asbestos researcher and health advocate Dr. Irving Selikoff wrote, in his 1978 book *Asbestos and Disease* that "[h]igh temperature jointing and packing materials" containing "[a]sbestos fiber" and "[c]ompressed asbestos fiber" present "[n]o health hazard in forms used in shipyard applications." (Exhibit 30 at p. 267).

80. The lack of concern for asbestos exposure from asbestos-containing gaskets and packing expressed in Navy documents and the writings of researchers such as Harries

and Selikoff is entirely consistent with my experience as a uniformed and civilian Navy occupational medicine physician.

81. In addition to the documents referenced and discussed above, the development of the Navy's knowledge of asbestos-related health issues and of appropriate workplace practices and controls to prevent exposure to elevated levels of airborne asbestos also is reflected, among others, in the documents listed on Exhibit B, which comprise part of the bases for my opinions on these topics.

III. CONCLUSIONS

82. The Navy made its decisions with respect to the use of asbestos in accordance with Navy operating requirements and in furtherance of Navy missions, and in light of the Navy's knowledge of associated health hazards at the time and of its perception of the requirements of federal law. The Navy's extensive and evolving knowledge of the hazards of exposure to asbestos and the means to control those hazards were weighed by the Navy against the benefits provided by its use. These benefits included meeting national defense needs in a standardized, efficient and low-cost manner that would not delay or hinder ship availability, especially during times of war. The Navy was informed in this decision-making by close contacts and liaison with relevant academic communities, professional organizations and other government agencies.

83. Similarly, the Navy's handling of and programs regarding workplace safety and hazard communication, as they related to asbestos and other issues, reflected the Navy's balance of various considerations, including combat readiness, maintenance of the necessary command structure, the needs of discipline and the hierarchy of risks

presented by life and work aboard a combat vessel. In general, the Navy chose to address long-term workplace health issues in the course of training for various trades and jobs, rather than using labeling or other written materials to accompany products into the workplace.

84. The Navy's occupational health program in no way depended upon, required or sought advice from equipment manufacturers regarding long-term occupational health issues, including those posed by exposure to asbestos dust. I have not uncovered – nor would I have expected to based on my research and experience and the extent of the Navy's knowledge in these areas – situations in which the Navy solicited from suppliers of shipboard equipment any information or guidance regarding the appropriate methods for the prevention of exposure to asbestos. Given the Navy's state-of-the-art knowledge concerning asbestos related hazards and its robust safety and health program, it would be unreasonable to assume that the Navy would have accepted any advice pertaining to asbestos related safety precautions from a manufacturer of equipment.

85. My opinions set forth herein are held to a reasonable degree of scientific certainty.

Pursuant to 28 USC § 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed on May 30, 2012 at Brookline, MA.

Samuel A. Forman, M.D.

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21 Department of Navy Memorandum re Hazards of Asbestos (December 9, 1968)

22 NAVSHIPS Instruction 5100.26 (February 9, 1971)

23 SECNAV Instruction 6260.3

24 Manufacturing Chemists' Association, Manual L1, "A Guide for the Preparation of Warning Labels for Hazardous Chemicals

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27 MIL-M-15071D, "Manual, Service (Instruction Books) for Shipboard Electrical and Mechanical Equipment" (June 6, 1961)

28 P. Harries, "Asbestos Dust Concentrations in Ship Repairing: A Practical Approach to Improving Asbestos Hygiene in Naval Dockyards," *Annals of Occupational Hygiene* (1971)

29 IARC, *Biological Effects of Asbestos* (1973)

30 I. Selikoff et al., *Asbestos and Disease* (1978)

Exhibit A

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EMPLOYMENT

2005 - present	**Oak and Ivy Health Systems, Inc.,** Cambridge, MA President Consulting services encompassing, quality management, disease management, intensive case management, business strategy, epidemiology and toxicology issues.
2003 - 2004	**Healthways, Inc.,** Westboro, MA Senior VP and Medical Director Medical direction for high-risk case management, comprising StatusOne services offered as a product line of American Healthways.
1997 - 2003	**StatusOne Health Systems, Inc.,** Westboro, MA Senior VP, Chief Medical Officer, Founder and Board Secretary Consulting, software and Internet services helping risk-bearing health organizations care for their frailest members. Develop predictive models, consult on the organization and execution of medical management services, formulate client relationships, contribute professional papers and monographs, evaluate competitive offerings, and represent StatusOne to medical audiences. Company acquired by Healthways, Inc., September 2003.
1995 - 1997	**Blue Cross and Blue Shield of Massachusetts,** Boston, MA Medical Director, Clinical Improvement General management responsibilities for pharmacy, home care, and several health care joint ventures. Lead clinical improvement projects involving all specialties in a 100,000 member integrated delivery system. Leadership of 150 people. Occupational medicine liaison with Raytheon Corporation. Provide general internal medicine care.
1986 - 1993	**Procter & Gamble Company,** Cincinnati, Ohio Consultant, later Associate Director, Occupational Health Manage U.S. self-insured health programs for 30,000 employees comprising the detergent, paper, pharmaceutical and food divisions. Build epidemiologic function, design, contract for, and execute studies. Model programs reapplied worldwide. Manage 5 physicians, 3 nurses plus support staff. Deliver clinical services to technical center staff and senior management. Direct 70 site clinics and 60 part-time physicians.
1984 - 1986	**Coastal Emergency Services, Inc.** Clinical services as emergency room physician and ambulatory family medicine at several Virginia community hospitals

MILITARY SERVICE

1982 - 1986 **Navy Environmental Health Center**
Norfolk, Virginia
Lieutenant Commander, later GS-14 Consultant in the occupational medicine division
Set standards, review complicated disability claims, apply statistical methods to health care delivery, inspect clinics for QA and UR, lecture on professional topics, perform epidemiologic studies and health hazard evaluations, represent naval occupational medicine on selected issues to outside organizations, manage development and implementation of clinical information management system.

1980 - 1982 **Naval Regional Medical Center**
Long Beach, California
Occupational Medicine Service; Head, Seal Beach Naval Weapons Station clinic. General and occupational clinical and preventive programs for 2,200 workers and 250 military personnel at conventional, nuclear capable, and special weapons industrial base. Manage asbestos medical surveillance program at Long Beach Naval Shipyard.

1978 - 1979 **USS St. Louis** (LKA-116) and **USS Duluth** (LPD-6)
Based at San Diego, California
Ship's physician
Western Pacific operations, general office and emergency practice. Vietnamese refugee assistance.

EDUCATION

1993 - 1995 **Yale** University School of Management,
New Haven, Connecticut
Master of Business Administration
Concentration in Organizational Behavior and Operations. Total quality management, health administration, finance, marketing, accounting and statistics.
Coordinator of Yale/Columbia Graduate School of Business Negotiation Colloquium.

1979 - 1980 **Harvard** University School of Public Health,
Boston, Massachusetts
Master of Science
Residency in Occupational Medicine

1977 - 1978 **National Naval Medical Center,**
Bethesda, Maryland
Internal medicine rotating internship
Assistant senior intern.

1976 - 1977 **Harvard** University School of Public Health,
Boston, Massachusetts
Master of Public Health

1973 - 1977 **Cornell** University Medical College,
New York, New York
Doctor of Medicine
MD-MPH program.

1970 - 1973 **University of Pennsylvania,**
Philadelphia, Pennsylvania
Bachelor of Arts magna cum laude
Majors in biology and history.

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ACADEMIC AFFILIATIONS

Harvard University, School of Public Health, Visiting Scientist in the Department of Environmental Health, 2007 – current.

Yale University School of Management, health sector symposia 2005 – current.

University of Cincinnati, chairman of the post-graduate Occupational Medicine Advisory Committee, 1988-1990.

Eastern Virginia Medical College, adjunct assistant professor of family practice and community medicine, 1983-1985.

LICENSES and CERTIFICATIONS

Licensed to practice medicine in Massachusetts, Virginia, California and Ohio.
Board certified in Occupational Medicine.

MEMBERSHIPS

Member, American College of Physician Executives, American Medical Association, and Massachusetts Medical Society
Fellow, American College of Occupational and Environmental Medicine.

INTERESTS

General management within health related and other businesses. Innovations, strategy and leadership in the cost effective delivery of medical care and the maintenance of high patient functional status. Enjoy travel, rowing, writing, numismatics, history, antiques. Company surgeon of the Lexington Minutemen historical reenactors.

Exhibit 1

US Navy Shipyard Occupational Medicine through World War II

Samuel A. Forman, MD, MPH

For more than 60 years the US Navy has maintained occupational health programs for its civil service workers in shipyards, arsenals, and aircraft repair facilities. The early history of the organization, people, and professional activities dedicated to the health of this large federal industrial workforce is examined.

Early efforts were stimulated by increasingly complex naval technology and worker compensation law. During World War II training, clinical, and preventive programs were pursued vigorously. Navy occupational health paralleled and at times led the development of occupational medicine and industrial hygiene in America.

The history of United States Navy occupational medicine encompasses health aspects of one of the largest federal industries during peace and war. It is a history paralleling, and at times leading, the development of occupation health in this country. This paper utilizes mostly primary sources to trace the origins of Navy occupational medicine through 1945, ending with the Second World War demobilization. The latter period marked a pause in professional progress and later activities are both within living memory and have been discussed elsewhere.[1]

In the late 19th century new seagoing technologies multiplied naval health hazards. Introduction of iron warships made naval construction and repair a diverse, heavy industry (Fig. 1). An array of occupational activities that were essentially unknown in the days of wooden ships and sail propulsion characterized work supporting the new fleets. In addition to the age-old injury problems of falls from scaffolding and rigging, there were hazards incident to riveting, welding, painting with rust-inhibiting lead paints, chipping, sandblasting, metal casting, ordnance loading, and electric wiring.

Several occupational health problems were recognized by 1900, but little preventive action was taken. For example, deafness among boilermakers and gunnersmates was an accepted fact of life.[2] Toxic conditions gained attention only if they afflicted many people and compromised a ship crew's readiness for duty.[3] Greater preventive medical interest was shown in the prevalent and pressing problems of sailors such as infectious diseases and minimally adequate shipboard ventilation.[4,5]

The health of civil service workmen in many shipyards and arsenals received little attention. Injuries might be treated in the station military dispensary,[6] at the discretion of the commanding officer. There was no provision for disability benefits if a prolonged health problem occurred.

Worker compensation laws enacted in the first [illegible] decades of the 20th century placed financial responsibility for occupational injuries on the employer. The first comprehensive compensation plan for federal employees became law in 1916. Unlike state plans, which were most often administered by insurance companies, benefits for Navy civil service workers were administered directly by the government through its Employees' Compensation Commission. The aggregate bill for benefits was served to the Secretary of the Navy each year. Financial losses resulting from civil service employees' worker compensation were deducted from the Navy budget. As dollar losses became a highly visible and painful reminder of occupational health issues, occupational health, previously an obscure topic, gained a measure of recognition.

The First World War witnessed a large increase in industrial activities in shipyards and supporting shore stations. More Navy physicians recognized that occu-

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The views presented are those of the author and do not represent the official position of the Department of the Navy or the Naval Medical Command.

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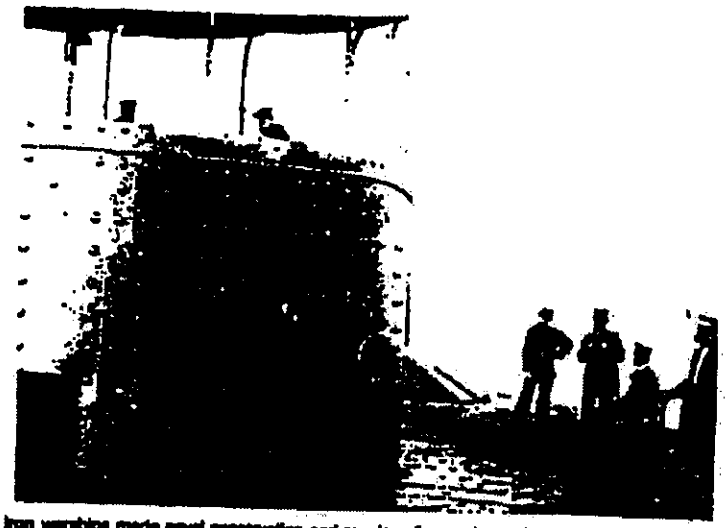

Fig. 1. Introduction of iron warships made naval construction and repair a diverse, heavy industry. The crew of USS Monitor observes its riveted iron turret and rifled steel cannon following the battle with CSS Virginia in 1862. (Courtesy of US Navy Imaging Command, Washington, DC)

pational health services, then consisting mostly of injury care and employment physical examinations, helped keep the work force on the job.[7,8] Although a few locations developed rudimentary occupational clinics, such interest remained the exception.

Poor compensation experience, as measured by both dollars and lost-time injuries, attracted critical comment from the Federal worker compensation program, whose administrator requested inspections of several Navy shipyards in 1917.[9] Detection and correction of toxic industrial hazards initially received a secondary priority to control of numerous and evident safety hazards.[10] Even so, Navy workers were maimed by exposed belt drives long after these dangerous mechanisms were safely enclosed in most private industrial establishments.

As WW I progressed, ineffective occupational health programs came to be recognized as impairing the war effort through needless waste of industrial manpower. Although plans for better services within both the Navy and the private sector took shape in mid-1918,[11,12] the end of the war halted their implementation. Navy government industries were rapidly demobilized to peacetime levels.

One legacy of the war years remained to sustain and advance the nucleus of a full-time Navy occupational medicine function. Criticism by the Employee Compensation Commission and the Secretary of the Navy for poor compensation cost experience led to ongoing programs in both safety and industrial hygiene. In 1917, a safety engineer was appointed and others were later assigned to each shipyard. In 1920, full-time medical officers were assigned to assist each safety officer in occupational health matters.[13] At the Navy Bureau of Medicine and Surgery, occupational medicine responsibilities were added to its preventive medicine division. From the beginning, organized occupational health was focused on the civil servants laboring in Navy shipyards.

An early initiative came from Dr Robert Jones at the Navy Bureau of Medicine and Surgery, who recommended periodic physical examinations for a variety of occupations based on their potential toxic exposures. Of interest, screening of asbestos workers for pulmonary disease was recommended along with examinations for more widely recognized conditions such as silicosis and lead poisoning.[14] Unfortunately, resources to provide such services were most often not obtainable from each base's commanding officer.

Nevertheless, a new vigor and purpose came to occupational health programs. Some performed excellent services for the Navy and workers at their locations. Boston Naval Shipyard Clinic sent two of its doctors in 1923 to complete postgraduate occupational medicine studies at the Harvard School of Public Health.[15] In 1925, Dr Ernest Brown completed a survey of lead poisoning in Philadelphia Naval Shipyard welders. He exhibited a disciplined and wide-ranging approach including clinical assessment, evaluation of work practices, and environmental sampling. Not content with passively describing the workplace, he devised hazard control strategies including altered work practices and adaptations of respiratory protection equipment.[16]

Other bases lagged in their occupational health and safety efforts. In some instances the occupational physicians might retreat into the clinic to be exclusively occupied with acute injury treatment. Military base safety officers were often untrained and ineffective.[17]

There was a growing appreciation for the importance of job-specific pre-employment physical examinations.[18] Unlike active duty sailors who had to pass an induction "pre-employment" examination before donning the uniform, civilian employees were examined only when required by the base commanding officer and under general guidelines of the Civil Service Commission. Pre-

employment examinations comprised a significant enterprise for the 1920s work force numbering almost 60,000.

Uniformed Navy personnel continued to receive variable occupational medical services. Almost from their introduction into the service, hazards inherent in aircraft and submarine environments gained the attention of dedicated medical professionals. When other occupational conditions were addressed at all, it was often in the context of a health problem severe enough to immediately impair health and fitness for duty. Examples include sailors' noise-induced hearing loss,[40,69] lead encephalopathy,[21] nitroglycerin poisoning,[70] and painting solvent intoxication.[71] These endeavors remained distinct from organized Navy occupational medicine, which remained oriented toward civil service worker health.

By the end of the 1930s, a small, full-time group of occupational health physicians had been in place for a number of years.[44] A few physicians, like Dr Ernest Brown, achieved superior competence in the practice of occupational medicine. Although all programs had not been uniformly successful, and adequate resources were hard to come by, the organization was poised to meet requirements arising from an anticipated industrial mobilization.[72]

As war clouds gathered, Rear Admiral Charles Stephenson (Fig. 2), in charge of preventive medicine at the Navy Bureau of Medicine and Surgery, faced the challenge of building upon the modest Navy occupational health program of the previous decades. The general approach to maritime industries was already being discussed. Navy yards, arsenals, and air stations would gear up to produce and maintain specific, often complex ships and weapons, yet remain flexible enough to accommodate anticipated battle repairs. Using an organizational model revived from WW I, the US Maritime Commission would give contracts to private companies to mass-produce vessels such as "Liberty" transport ships and landing assault craft.

Immediate challenges included defining the scope of Navy occupational health, obtaining the backing of the military hierarchy, and staffing the effort with trained individuals. A coherent blueprint for the content of military occupational health was provided by Dr Ernest Brown. He envisioned services to include clinical care for injuries, job placement medical certifications, surveillance examinations for noxious work exposures, and workplace hazard inspections and controls.[24,27]

The next challenge was providing skilled manpower at a time when large industries monopolized the few qualified people.[73] The most viable answer was a timely proposal from Philip Drinker at the Harvard School of Public Health for training military officers in short courses of instruction.[74] Professor Drinker was already a well-known authority who had invented the "iron lung" mechanical respirator in 1929,[75] devised means to quantify and control industrial dust exposures,[76] and pioneered concepts in permissible exposure limits. Stephenson sent two bright Navy physicians, Drs Otto Burton and Howard Karl Sessions, to complete the occupational medicine master's degree program at Harvard during 1941.

Concurrently, Stephenson worked to empower the organization to tackle expanded responsibilities without external interference. An unsolicited attempt by the Public Health Service to perform occupational health inspections of naval facilities was promptly declined,[24,25] reportedly with the support of President Roosevelt.[24] For industrial activities all occupational health services would be provided from within the Navy.

The new Navy program was adopted and announced with some fanfare[24] (Fig. 3). It included pre-employment examinations,[24] injury care, medical surveillance for known occupational health hazards, and industrial hygiene field surveys. Shipyards developed well-staffed occupational health services manned by professionals in uniform and comprising both clinical and industrial hygiene divisions. These were located at the largest industrial facility in each of the 12 naval districts and lent occupational health support to smaller naval facilities in their areas.[27]

Key manpower was to be provided by training uniformed officers in short courses as proposed by Philip Drinker. By the war's close some 111 naval officers had completed the courses, most classes having convened at Harvard[24] and a few at Columbia[25] Schools of Public Health. Of interest, 39 officers, unlike their classmates, were non-physicians, a group comprising one of the first formal training programs in modern industrial hygiene. Both physicians and hygienists shared formal lectures but separated during laboratory periods. Doctors attended industrial clinics and hygienists learned sampling strategies, laboratory assays, and hazard-control techniques. An additional 16 hygienists were taken on active duty, having already gained experience in industrial settings.

The role of occupational health within the US Mari-

Fig. 2. Rear Admiral Charles S. Stephenson (1887–1985) was instrumental in designing and implementing the Navy occupational medicine program during WW II. (Courtesy of the Naval Medical Command, Washington, DC)

Fig. 2. As illustrated by contemporary poster art, injury care, physical examination, and protective measures were aspects of the Navy wartime occupational medicine program. (Courtesy of the National Archives, Washington, DC)

time Commission evolved in 1948. Philip Drinker was also active here.[42] As chief medical consultant he was instrumental in the adoption of joint Navy - Maritime Commission health and safety standards for contract shipyards.[43] The health guidelines were based largely on the experience of a traveling health team's findings in the course of inspections of representative shipyards. In August 1943, the team was professionally staffed with loaned Navy physicians and industrial hygienists.

Contract shipyards that the Maritime Commission supervised provided their own injury treatment measures, whereas industrial hygiene inspection services were provided by government personnel. Qualified people were unavailable to institute the inspection services, so arrangements were made with the Navy to provide uniformed men. They were assigned to four regional offices: one physician and two industrial hygienists each to Philadelphia and Oakland and one industrial hygienist each to the offices in New Orleans and Chicago.[42]

In contrast to the program of the Maritime Commission, the Navy occupational health program had no traveling consultants or inspectors. When occupational health issues of general importance to naval industries arose or when special expertise beyond that in each naval district was required, Drinker's team was consulted. Health questions related to welding[43,44] and asbestos insulation work were the subjects of health hazard evaluations by the Maritime Commission during the war.

Asbestos workplace field investigations have had long-term significance. There had been anecdotal case reports implicating asbestos in lung disease from naval shipyard clinics.[45-47] A Maritime Commission field survey at a civilian contract shipyard revealed two laggers with x-ray evidence of asbestosis among a small number of tradesmen.[48] Navy occupational health officers were concerned enough about such findings that they cooperated with Philip Drinker in his proposal to do a large-scale pulmonary survey of asbestos insulation workers and obtained permission to extend the survey to two naval shipyards.[49]

Only three asbestosis cases were identified among more than 1,000 asbestos insulation workers who participated in the chest x-ray screenings at four shipyards.[50,51] Disease prevalence appeared low, an artifact caused by the inadvertent dilution of the at-risk population with briefly exposed persons. Low asbestosis prevalence in shipyard workers was interpreted in the professional community to mean that asbestos lagging operations were relatively free of pneumoconiosis risk.[52] Although these early studies concerning asbestos hazards did not stand the test of time,[53,54] they represented superior occupational health methods of their era.

Industrial health activities were rapidly demobilized by 1946. The Maritime Commission health consultation office was disbanded. Although few physicians and industrial hygienists remained in active Navy service, those who gained experience during the war, like Drs. Otis Burton and Howard Karl Sessions and industrial hygienists Sidney Goren and George Johnson, led Navy programs through the 1950s.

Navy occupational health had played an important role in wartime industries. Its organization included superior practitioners. It broke new ground for industrial hygiene as a distinct health-related profession. It confidently tackled known health issues and actively pursued newer ones. Members of this team, veterans of occupational medicine and industrial hygiene services in Navy shipyards, arsenals, air stations, and the Maritime Commission, shared a common experience. Taking their know-how with them into private industry, government, and academia, Navy programs left a distinctive mark on American occupational health for many years.

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Exhibit 2

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INDUSTRIAL HYGIENE AND THE NAVY IN NATIONAL DEFENSE

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Captain, Medical Corps, United States Navy
NEW YORK

One of the most important concerns of the Medical Department of the United States Navy today is industrial hygiene, especially in navy yard practice. This is a situation of ever increasing moment in view of the present era of enormous expansion in naval construction, unparalleled in the history of the United States. This is bringing about a vast increase in the industrial force of the navy yards, and in all probability new problems in industrial hygiene will emerge incident to new materials and processes.

It should be remembered in this connection that the policy of the Navy Department is to allot new naval construction on an equal basis to government and commercial yards. It follows that the commercial establishments are also undergoing rapid development, with an enormous rise in industrial personnel. They will therefore be confronted with problems of industrial hygiene similar to many of those arising in navy yards.

Industrial hygiene is a field which is now undergoing rapid development. This appears to be due to certain significant trends, the most important of which has been the recent setting up of many industrial hygiene units in state or city departments of health through funds released by the passage of the Social Security Act. These trends, in fact, particularly that just mentioned, reflect a definite renaissance of industrial hygiene as a phase of public health in the United States.

This movement is receiving increasing recognition in naval industrial circles, and industrial hygiene is now listed as a specialty of the naval medical officer along with other specialties outside the purely clinical fields, such as aviation medicine, submarine medicine and chemical warfare medicine.

Those just mentioned, however, are concerned primarily with naval personnel. Industrial hygiene, on the other hand, is largely occupied with federal industrial personnel. It therefore follows that the status of the senior medical officer of a major navy yard in relation to the industrial

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War Medicine, v. 1: 3-14, 1941

department is analogous in many respects to that of the medical director of a large commercial industrial plant. The object of this paper is to present an outline of the administration of industrial hygiene in navy yards, which are the chief industrial units of the Navy.

Mention should be made in this connection of the Subcommittee on Industrial Medicine of the Health and Medical Committee of the National Defense Council. The Surgeon General of the Navy is a member of the latter committee and is represented by two liaison naval medical officers in conjunction with the Subcommittee on Industrial Medicine. Important recommendations pertinent to the Navy and industrial health will result, and many of them undoubtedly will be put into effect.

The term industrial hygiene as applied in the present discussion is used in the specific sense of the prevention and control of occupational disease. The fact may be of interest that the first compensation law for occupational diseases in this country was one passed in 1908 by Congress for United States civil service employees. Compensation laws for industrial diseases have lagged far behind legislation covering accidents. Only sixteen states of the Union provided compensation for one or more occupational diseases up to the year 1937, although all but two provided legislation for accidental injuries.

INDUSTRIAL ORGANIZATION OF NAVY YARDS

The mission of a navy yard is primarily the construction, maintenance and repair of naval vessels. The central administration of navy yards and, in fact, of all industrial shore stations of the Navy is vested in the Assistant Secretary of the Navy, in whose office is the Shore Establishments Division of the Navy Department.

There are eleven navy yards, located as follows: Portsmouth, N. H.; Boston; New York; Philadelphia; Washington, D. C.; Norfolk, Va.; Charleston, S. C.; Mare Island, Calif.; Puget Sound, Wash.; Territory of Pearl Harbor, Territory of Hawaii; and Cavite, Philippine Islands.

In addition, mention should be made of the following specialized industrial plants: the plants for the building of submarines at Portsmouth, N. H., and Mare Island, Calif.; the Naval Gun Factory at the Navy Yard, Washington, D. C., for the production of high caliber naval guns, torpedo tubes and accessories; the torpedo factories at Newport, R. I., and Alexandria, Va., for the manufacture of torpedoes; the powder plant at Indian Head, Md., for the production of Navy smokeless powder; the aircraft factory at Philadelphia for experimental air craft construction and repair; the naval armor plate plant at Charleston, W. Va., and the Naval Clothing Factory at Brooklyn.

Organization of the New York Navy Yard.—The New York Navy Yard may be taken as typical of a major yard. Its organization falls under two departments, i. e., the industrial department, headed by a naval captain of the engineering branch, and an operations or military department, under the direction of a naval line captain. As a conservative estimate it may be stated that 90 per cent of the activities of a navy yard are industrial.

Under the industrial manager there are at present twenty-three shops of different types, with a force per shop varying from 30 to 3,200 men. The total number of civil employees of this yard is now approximately 17,000. This is rapidly rising and, it is estimated, will exceed 20,000 in 1941.

EXTENT OF THE CIVILIAN INDUSTRIAL FORCE OF THE NAVY

The combined industrial force of all navy yards is now approximately 130,000. In view of the pending program of naval construction it is estimated that this number will reach 150,000 in 1941. If made inclusive of all shore stations it will probably be close to 180,000.

In addition to the industrial force of navy yards, one must consider the employee volume in the commercial naval ship-building plants, such as the Newport News and Dry Dock Company, the New York Shipbuilding Corporation at Camden, N. J., and the Bethlehem concern at Quincy, Mass., which now employ from 12,000 to 15,000 men each. It is a conservative estimate that the combined industrial personnel of all such plants on both the east and the west coast will reach a peak of over 100,000.

ORGANIZATION OF THE MEDICAL DEPARTMENT OF A NAVY YARD

The medical staff of the New York Yard consists of ten medical officers, five dental officers, one nurse, forty-five enlisted men and two civilian clerks. The chief activities with reference to industrial personnel may be summarized as follows:

(*a*) Preemployment physical examinations. All applicants for federal jobs are examined physically, although the standards for acceptance vary to some extent for different occupations.

(*b*) Periodic physical examinations. These, of course, are conducted with the object of medical supervision of certain groups of employees exposed to definite potential health hazards, such as foundrymen and spray painters.

(*c*) Physical examination of federal employees for retirement. This is for evaluation of the degree of disability and opinion as to disposition when total disability is alleged.

(*d*) Diagnosis, treatment and disposition of industrial injuries and occupational diseases.

(*e*) Administration of compensation cases. (*f*) Industrial hygiene and plant sanitation.

THE INDUSTRIAL MEDICAL OFFICER

An officer of the medical staff of the navy yard is specifically detailed for industrial hygiene administration subject to the direction of the senior medical officer. Figure 1 outlines the scope of his activities.

(*a*) Advice to the safety engineer. The adequate practice of industrial hygiene in navy yards, as in civil industry, is dependent on the close and efficient correlation of the work of the safety engineer and that of the industrial medical officer. It is essential to obtain a grasp of the functions of both officers in order properly to visualize industrial hygiene administration.

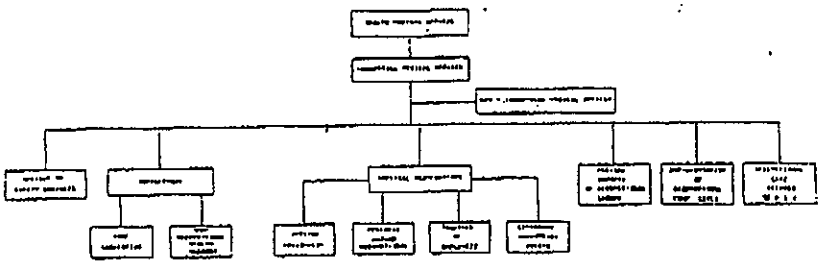

Fig. 1.—Organization for administration of industrial hygiene in navy yards.

(*b*) Inspection. The industrial medical officer is responsible for the general supervision of plant sanitation, i. e., ventilation, illumination, water supply, general cleanliness and adequacy and condition of sanitary facilities. He also conducts shop inspections for occupational health hazards and measures for their control. He cannot expect to evaluate working conditions and thereby detect occupational health hazards early unless he makes periodic inspections through the plant. In this way he can observe the adequacy of existing measures against specific hazards and decide whether such methods are being properly utilized. These inspections also have a psychologic value, in that they create greater respect for the medical service in the minds of the employees.

(*c*) Supervision of special physical examinations. This includes handling of preemployment cases when the applicant reports previous exposure to potential industrial health hazards, such as lead fumes or foundry dust; periodic examinations of groups exposed to such potential occupational hazards, e. g., spray painters and sandblasters; examination

of persons referred for transfer to other shops where there is a question of occupational disability, and clinical studies for a decision as to industrial origin of obscure disabilities. (*d*) Medical surveys of occupational groups.—This will be discussed later. (*e*) Administration of the medical aspects of claims for compensation for occupational disease pending before the United States Employees' Compensation Commission. (f) Supervision of preparation of accident and occupational disease reports for the Navy Department.

THE SAFETY ENGINEER

A civilian safety engineer is stationed at the Navy Department as the adviser to the head of the Shore Establishments Division. A naval officer is assigned to each navy yard as the safety engineer.

1. Accident and Unsafe Practice Control.—Safety engineering is one of the divisions of the navy yard organizations. The safety engineer conducts an investigation of all lost time accidents with a view to fixing the cause and advising measures to prevent their recurrence. The basic features of approach to the safety problem in navy yards are provision of safety devices, such as mechanical guarding, and the safety education of workmen and their supervisors.

Another important aspect is the competitive approach, which has proved effective in stimulating interest in accident prevention. The Navy Department publishes the comparative safety scores of all navy yards monthly.

Figure 2 emphasizes the advance made by the Navy Department in accident reduction, beginning with an intensive safety campaign in navy yards in 1926. The period covered is from 1926 to 1937 inclusive. The accident rate was lowered from 20 to practically 10 per year in a twelve year period; the severity rate reduced from 2.2 per year to 0.5. On the other hand, it will be noted that the total man hours worked during the period increased to 115 million from 65 million per year, the average number of employees rising from approximately 30,000 to 66,000.

2. Occupational Health Control.—The control of occupational disease in navy yards naturally lies within the sphere of both the safety engineer and the industrial medical officer. Although the safety engineer is administratively charged with this task, the medical officer is actually coordinate with him in this phase.

As a matter of fact, the medical officer is the key man in the prevention of industrial disease in navy yards, in that he usually discovers its existence. The diagnosis having been made, the occupational history and the preemployment examination record are carefully reviewed in order to reach a decision, if possible, whether the hazard can be traced

to present or past employment. If it is ascribed to or aggravated by environmental conditions, the medical officer confers with the safety engineer, and an industrial hygiene survey is usually recommended to the commandant.

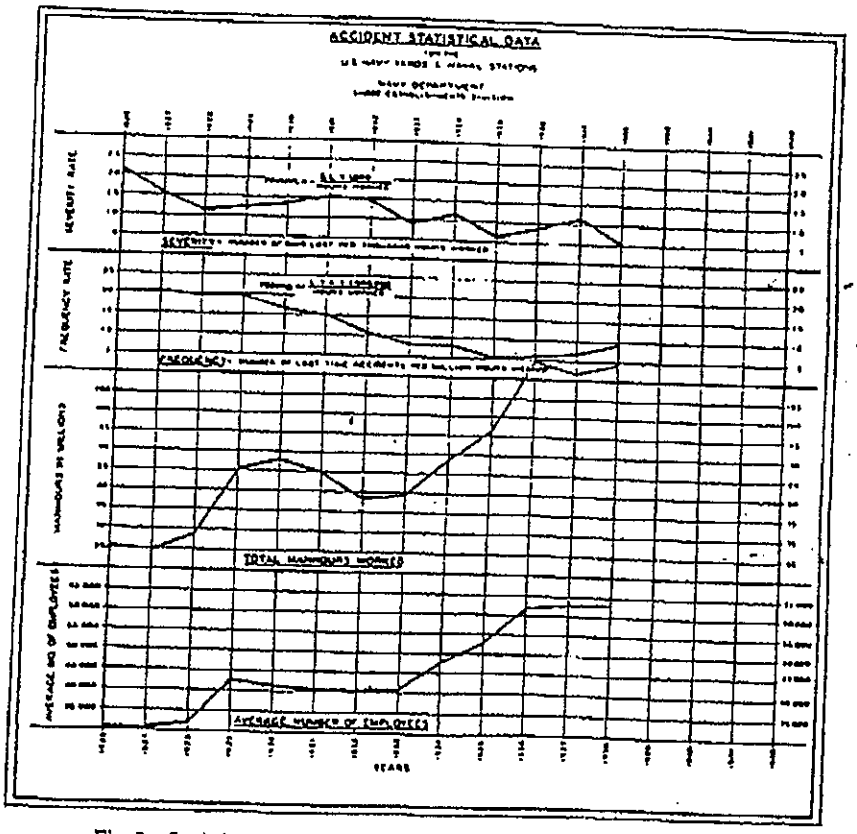

Fig. 2.—Statistical data on accidents for the United States navy yards and naval stations.

THE INDUSTRIAL HYGIENE SURVEY

An industrial hygiene survey is of course a combined medical and engineering task.

1. The Medical Survey.—This consists of a complete clinical study, with detailed occupational histories of all exposed personnel as a case-finding procedure under the supervision of the industrial medical officer.

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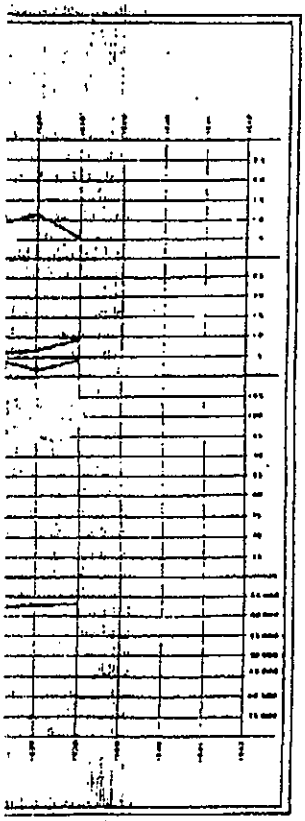

States navy yards and naval

URVEY
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Although not directly responsible beyond the medical survey, it is important that the medical officer have a reasonable grasp of the entire problem so that he will be in a position to utilize all data that have any bearing on the interpretation of his medical findings. In addition, he may act in an adivsory capacity to the safety engineer with respect to certain technical phases in the planning and conduct of the engineering aspects of the survey.

2. The Engineering Survey.—The engineering phases of an industrial hygiene survey in a navy yard fall, naturally, under the direction of the safety engineer. As in a commercial industry, this embraces essentially a complete story of the occupational duties, the physical conditions of work, and the materials, processes and equipment of the individual shop; in other words, the environmental conditions.

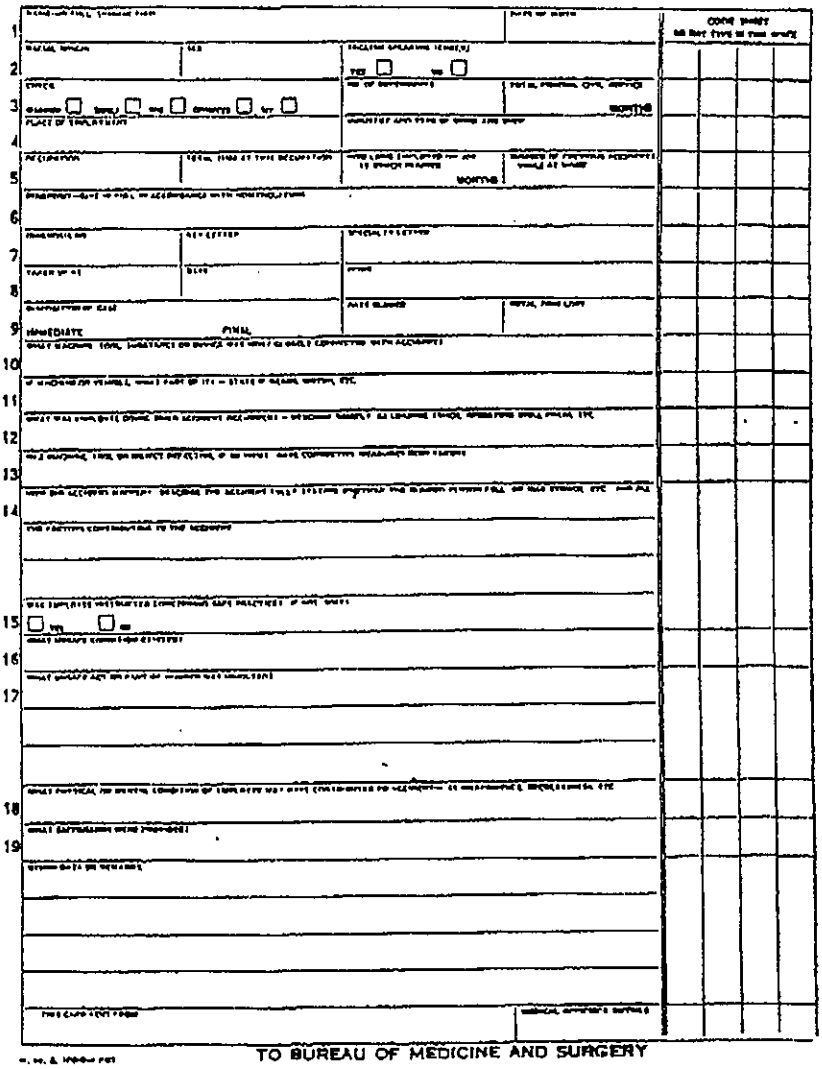
Laboratory facilities: No facilities are provided for technical studies in the navy yard organization, and there is no central laboratory unit in Washington which could supply industrial hygienists for field studies. This is an urgent need, and recommendations have recently been made to the end of setting up such an agency.

The Navy Department has been most fortunate in the past in securing the services of the Division of Industrial Hygiene of the United States Public Health Service to conduct such technical studies, much in the same way that industries in the states utilize the facilities of state bureaus of industrial hygiene.

The safety engineer formulates the control program of the health hazard on the basis of the data obtained in the survey. After all, once the cause is disclosed, prevention of occupational disease is largely an engineering problem.

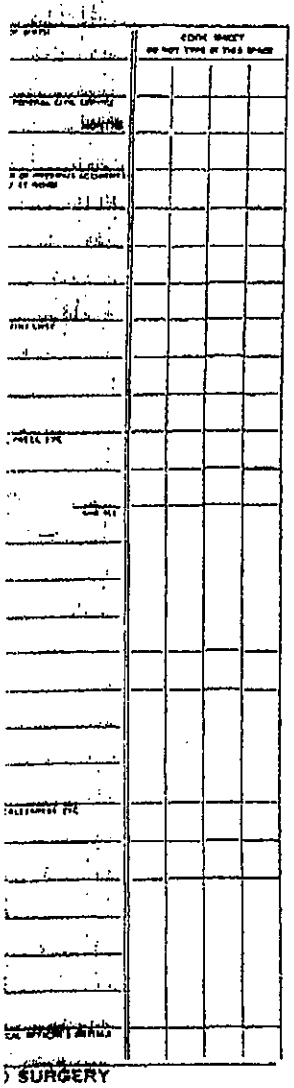
THE REPORTING OF INDUSTRIAL ACCIDENTS AND ILLNESS

An important advance in accident prevention by the Navy was initiated on July 1, 1940, when the Secretary directed that a report of each accident and illness, both "lost time" and "no lost time," occurring among civil personnel of navy shore establishments be made to the Bureau of Medicine and Surgery. The report of each accident is submitted on a form, known as form F-C (fig. 3). This presents the diagnosis of the injury and the essential details as to the cause. Punch cards are made up from these records for mechanical tabulating and indexing through a sorting machine. This provides facilities for the statistical analysis of these accidents and diseases, and the data obtained promise to be a far reaching contribution to the subject of accident control. Prior to use of this system a crude system of accident reporting to the department was in effect, but it was not adapted to statistical analysis.



TO BUREAU OF MEDICINE AND SURGERY

Fig. 3.—Form for report of industrial disability.



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disability.

OCCUPATIONAL HEALTH HAZARDS IN NAVY YARDS

The chief potential occupational health hazards in navy yards will now be considered as indicated in the accompanying table. The data are based chiefly on reports to the United States Employees' Compensation Commission over a series of years. It hardly requires emphasis that industrial medical officers must be constantly on the alert for new health hazards.

Occupational Health Hazards in United States Navy Yards

1. Dust Diseases
   (a) Silicosis: foundry workers and sandblasters.
   (b) Asbestosis: makers of pipe insulating covers
2. Diseases Due to Lead and Lead Compounds
   (a) Spray lead painters
   (b) Brush lead painters
   (c) Lead putty workers
   (d) Oxyacetylene welders: cutting and scrapping of ships
   (e) Handlers of molten lead: preparation of Babbitt metal and lead coating of metals
   (f) Handlers of lead azide: used in pulverized form as a detonator in naval munitions
3. Diseases Due to Volatile Organic Solvents
   (a) Lacquer spray painting
   (b) Degreasing of machinery: benzene, toluene, xylene, trichlorethylene, higher alcohols, etc.
4. Diseases Due to Roentgen Rays and Radium
5. Diseases Due to Welding
   (a) Nitrous gases
   (b) Metallic oxides, of potentially toxic nature: manganese, lead, fluorides, silicon, zinc, etc.
   (c) Zinc fume fever
   (d) Eye hazards: actinic ophthalmia chiefly
6. Chromate Poisoning: electric platers
7. Diseases Due to Ingestion of Radium: painters of luminous dials of instruments
8. Injuries from Nitro Explosives: workers in high explosives, such as T. N. T. and tetryl (tetranitromethylaniline)
9. Diseases Due to Metallic Dust
   (a) Excessive pulmonary fibrosis: grinders, buffers and polishers: carborundum, alundum, etc.
10. Dermatoses: Machine operators from contact with cutting and soluble oils
11. Diseases Due to Excessive Heat: heat cramps, heat exhaustion and heat stroke
12. Caisson Disease: diving operations
13. Functional Disturbances
   (a) Anoxemia: from entering confined spaces
   (b) Phosgene poisoning: from carbon tetrachloride used to extinguish fires in confined spaces
   (c) Carbon monoxide poisoning: incident to all fires in confined spaces

1. Dust Diseases.—(*a*) Silicosis: Important units of all navy yards are iron, steel and brass foundries. The dust control problem is a major concern in these plants as in civil industry.

One of the difficulties met with in combating the foundry dust problem in navy yards is the fact that silica (silicon dioxide) dust is not particularly irritating or obnoxious in concentrations which may ultimately lead to pulmonary damage. As a result there is a tendency to an indifference on the part of the workers and even of the supervisors and executives which must be overcome in order to accomplish effective and permanent dust control. Another reason for this attitude is the long period necessary for silicosis to develop in foundry workers exposed to only moderate concentrations of dust, such as molders.

A medical survey of the foundries of the Navy Yard, Washington, D. C., was conducted by me in 1939. Of 525 men subjected to roentgen examination, approximately 60 per cent had a record of ten years or over and 36 per cent a record of twenty years or over of total foundry employment. Silicosis was found in 12, or 2.4 per cent of the total—in all of them in stage 1 or 2; these data led to recommendations for improved methods of dust control.

Industrial hygiene surveys in foundries other than the Washington Navy Yard have not as yet been carried out but would in all probability disclose a certain incidence of silicosis, even if not of the disabling type. The medical control of silicosis in the naval establishment consists of roentgen examination of the chest before employment and an annual roentgenogram of every man exposed to the higher silica dust concentrations, such as sandblasters and shake-out men.

(*b*) Asbestosis: This is a potential occupation disease hazard due to inhalation of asbestos dust among workers engaged in the manufacture of asbestos insulating covers for flanges, valves and high temperature steam turbines.

I recently conducted a medical survey of the workers of the pipe-insulating shop of the New York Navy Yard, inclusive of roentgen studies. The maximum working period of exposure was seventeen years. No cases of asbestosis were found. Similar findings have been reported from two other yards, but the study should be extended to all men in this trade.

Medical control consists of taking a roentgenogram of the lungs annually. The material is moistened, and localized exhaust ventilation is installed over the work area. A respirator is worn during the dustiest aspect of the process.

2. Diseases Due to Lead and Lead Compounds.—Lead poisoning has become comparatively infrequent in recent years both among industrial and among service naval personnel. This is apparently due partly to changes in materials and methods and partly to improved measures of control. Zinc and titanium paints have largely replaced leaded material for ship interiors. Red lead paint is still in use as the priming coat on hull exteriors, but the finishing coats contain either no lead or a greatly reduced proportion. All painters regularly handling lead-containing paint are examined semiannually for evidences of lead absorption.

3. Diseases Due to Volatile Organic Solvents.—Lacquer spray painting is done on an extensive scale in navy yards and therefore demands rigid medical supervision. Another important application is in degreasing measures. All spray lacquer personnel are subject to semiannual physical examination.

4. Diseases Due to Roentgen and Radium Hazards.—Radium and roentgen rays are continually utilized for the detection of flaws in castings

and pipe-welded joints for high pressure steam installations. Radium has an advantage in the small size of the equipment in that it is adapted to tests in the confined machinery spaces of ships.

The question of protection from irradiation of the operating and other personnel working in the vicinity of the apparatus has received thorough study, the practice of the Bureau of Standards being generally followed. Complete blood counts of all technicians are conducted quarterly, and special preemployment examinations are prescribed.

Another potential hazard of radium is that of ingestion incident to radium painting of luminous dials, especially for fire control instruments and aircraft. The control measures advised by the Public Health Service are generally in force plus certain local regulations.

5. Diseases Due to Welding.—The hygienic supervision of welders is another outstanding feature of medical responsibility. Approximately 2,500 welders were on the rolls of the combined shore establishments as of Jan. 1, 1940, including 653 at New York. This number has progressively increased and will continue to rise.

The immense volume of work in confined spaces is characteristic of naval welding. A battleship of 35,000 tons displacement under construction contains approximately 500 compartments in which electric welding is mandatory; certain of these spaces are extremely small and force the welder to work in very cramped positions. These conditions complicate the question of effective preventive control of the hazards.

The chief hazards which have to be considered at present are "nitrous fume" poisoning, zinc fume fever, as it is popularly termed, and actinic opthalmia from ultraviolet irradiation of the welding arc. "Nitrous fume" poisoning, while comparatively rare, is a serious condition. No emphasis need be placed on the fact that these injuries would be still further reduced in number if the control measures provided were properly utilized.

It may be of interest to note that in 392 cases of actinic ophthalmia reported at the New York yard in the first ten months of 1940, only 30 per cent of the patients were welders, apprentice welders, helper welders and tack welders; the remaining 70 per cent were men exposed in spaces adjacent to the welding arc or assisting in welding operations but not utilizing available protective goggles.

Chronic poisoning among naval welders from manganese, fluorides or silicon, which might be ascribed to inhalation of these metallic or mineral oxides in the welding fumes originating in the rod coatings, has not been reported. The possibility of such poisoning, of course, cannot be denied.

Limitation of space prevents mention of additional occupational health hazards.

ANNUAL EXAMINATIONS OF CRANE OPERATORS, ENGINE MEN (HOISTING AND PORTABLE) AND LOCOMOTIVE ENGINEERS

These classes of workers are physically examined annually, with special emphasis on blood pressure, hearing and vision. In view of the nature of their duties, physical failure, such as sudden collapse, might involve critical injury to themselves and others and, in addition, damage to material. If corrective measures are impracticable the worker is retired or transferred to some suitable type of employment. A crane operator, for instance, presenting marked hypertension would be referred to his private physician and transferred to other duties.

LOSS OF TIME FROM INDUSTRIAL VERSUS NONINDUSTRIAL DISABILITIES

In a limited study of 116 industrial companies in various parts of the United States conducted by the American College of Surgeons a few years ago, it was found that the loss of time from nonindustrial types of illness was approximately fifteen times that industrially connected. In my capacity as senior medical officer of the Washington Navy Yard I made the following observations for the calendar year 1938: total industrial force, 7,000; average number of days lost from industrial accidents 0.14, and average number of days lost from nonindustrial illness or accident, 5.20. The time lost from nonindustrial disability was therefore thirty-seven times that lost from industrial causes. A similar study made by me at the New York Navy Yard for 1939 revealed that the time lost from industrial causes was roughly four times that from nonindustrial causes. The possible factors in the difference between the two yards have not been analyzed.

Disparities of the same general order have been reported in recent statistical studies by certain large commercial industries and reflect an enormous economic loss. Much of this nonindustrial illness is preventable. It is believed that in the naval establishments this wastage due to preventable illness can be greatly reduced if the problem is attacked by an annual physical examination of all employees, men requiring corrective treatment being referred to their private physicians or to other agencies. This would require a heavy increase in medical staffs, but it would be a profitable investment by naval industry in the saving of man power for national defense. It is a question worthy of being explored.

Exhibit 3

U. S. Navy Department • U. S. Maritime Commission

573-1-6

Minimum Requirements

FOR

SAFETY AND INDUSTRIAL HEALTH

IN

CONTRACT SHIPYARDS

1943

Approved
U. S. Navy
Jan. 20, 1943

Approved
U. S. Maritime Commission
Feb. 9, 1943

United States Government Printing Office • Washington • 1943

U. S. NAVY DEPARTMENT
WASHINGTON, D. C.

U. S. MARITIME COMMISSION
WASHINGTON, D. C.

To All Contractors Constructing Ships for United States Navy-United States Maritime Commission:

As a result of the national conference on safety and health in shipyards holding contracts with the United States Navy and Maritime Commission, conducted under the auspices of these agencies in Chicago December 7 and 8, 1942, a unanimous agreement was reached upon the minimum standards which have now been approved by the Navy Department and United States Maritime Commission and which should be put into effect in shipyards holding contracts with the two agencies.

These standards represent a specialized study based upon a fact-finding survey on all coasts by experts in that field. They have received the unanimous concurrence of the representatives of the medical and safety departments and of labor-management committees from shipyards on all coasts.

The necessity for conserving manpower and promoting the physical welfare, health, and safety of what shortly will amount to one million workers in shipyards requires that careful observance of standards for the prevention of accidents and protection of health be accorded. Aside from the weight which must be given humanitarian considerations, it is simply good common sense that as much care and attention be given to protecting the human factors in the war production program as is given machines.

Under the administrative direction of the Maritime Commission, safety and industrial health consultants will be made available in all regions wherein shipyards holding contracts with the Navy and the Commission are located.

Each contractor is hereby given notice that the Navy Department and the Maritime Commission will expect full and complete compliance with the minimum standards which bear the approval of the Navy Department and the Maritime Commission, and each is requested to give full cooperation to the consultants on health and safety who will be charged with the coordination and supervision of the safety and health programs of the two agencies.

The cumulative restriction of manpower makes speedy attention and comprehensive action in respect to the subject matter hereof of vital importance.

Frank Knox

FRANK KNOX, *Secretary of the Navy.*

E. S. Land

E. S. LAND, *Chairman,*
U. S. Maritime Commission.

UNITED STATES NAVY—MARITIME COMMISSION

MINIMUM REQUIREMENTS

FOR

SAFETY AND INDUSTRIAL HEALTH IN CONTRACT SHIPYARDS

S and H-1. Introduction.

1.1 The standards for industrial health and safety as presented in this manual cover only minimum requirements. It is not to be assumed that compliance with these minimum standards is insurance of the development of good health and safety records.

1.2 It is recognized that in many shipyards, standards for health and safety are already in effect which go beyond the requirements of those listed here. The Maritime Commission and Navy urge that any standards of higher level be continued and that where substandard conditions of health and safety exist, they immediately be brought to the required standard or better.

1.3 In all cases the use of the words *shall* or *must* indicates that compliance with that section of the minimum requirements is mandatory. Where the words *should* or *may* are used the section may be considered desirable but not necessarily mandatory under certain circumstances which the contractor in his discretion may determine.

MINIMUM REQUIREMENTS FOR INDUSTRIAL HEALTH

H-2. Medical Facilities.

2.1 *Personnel.*—Yards employing up to 5,000 men should have two full-time physicians, and one additional physician for each additional 5,000 men. Yards with less than 2,000 to 3,000 men will not need full-time physicians.

2.2 Specialists in the various branches of the medical profession available in the area should be consulted as indicated.

2.3 Yards employing up to 5,000 men should have in the main dispensary six full-time nurses and three additional nurses for each additional 5,000. Additional nurses will be required for first aid stations.

2.4 There should be at least three clerks employed in the medical department for each 5,000 employees.

2.5 One ambulance driver should be available per ambulance per shift.

H-3. Physical Facilities.

3.1 The medical department should be provided with:

a. A waiting room with suitable registration facilities.

b. A general treatment room.

c. An eye treatment room.

d. A minor surgery room.

e. A ward with three beds for the first 5,000 employees, and one bed for each additional 10,000.

f. Doctors' offices and private examining rooms.

g. A nurses' office and dressing room.

h. X-ray room for yards employing 5,000 men and above.

i. A physiotherapy room.

j. Toilet facilities for doctors, nurses, and patients.

k. A storeroom for general medical stores.

l. X-ray files and viewing room.

3.2 First-aid treatment rooms, manned by nurses, should be provided wherever there is overcrowding at the main dispensary and loss of time due to distance from shipways and shops. These sub-stations may be located under building ways or near locations where the number of men working is large so that the distance a man need travel to a sub-station will not exceed approximately 400 yards.

H-4. Equipment.

4.1 The following equipment should be provided:

a. One ambulance for each 15,000 employees, or reasonable fraction thereof, with an ordinary passenger car always in reserve.

b. In some yards a station wagon is used satisfactorily inside the yard and an ambulance used only for trips outside.

c. An X-ray unit for yards employing about 5,000 men and above.

d. Medical and surgical stores required for minor surgery, eye injuries and physiotherapy.

H-5. Records and Forms.

5.1 The following records and forms are recommended:

NOTE.—*In an emergency no form need be filled out.*

a. A form authorizing the workman to report to the medical department for examination or treatment issued by a foreman or leading man or other supervisor. This shall show time of issue, arrival at dispensary, discharge from dispensary and return to work.

b. Appointment form for revisits and retreatments issued by the physicians and nurses.

c. A disposition form issued by physicians and nurses indicating return to work, hospitalization, to home, or other disposition.

d. A complete and accurate permanent filing system recording personal data, nature and cause of injury, diagnosis, treatment, disposition, and results.

e. The necessary state and insurance company forms.

f. Daily report to the safety department showing all new cases for the day, together with the nature and cause of injury, and the *diagnosis.*

g. The adoption of the standard nomenclature when made available by the Council on Industrial Health of the American Medical Association, Chicago, Illinois.

H-6. Examinations.

6.1 Physical examinations to insure proper placement of employees shall be given.

6.2 Periodic check examinations shall be given men working in occupations potentially hazardous to themselves or others, as for example to crane operators, locomotive and hoisting and portable engineers. Periodic check examinations should be given men in jobs in which there may be health hazard, as for example to sand blasters, radium and X-ray workers, and paint sprayers.

6.3 Special examinations such as X-ray, seriologic and urinalyses shall be given in the individual case as indicated and in accordance with local needs.

H-7. Air Raid Precautions.

7.1 The medical department shall locate, equip, and maintain such emergency first aid dressing stations as may be deemed necessary to handle air raid casualties.

7.2 A certain number of yard employees shall be trained in first aid procedures to render assistance to the medical department in handling air raid victims.

7.3 Close cooperation should be maintained with the local civilian defense officials in order that evacuation and care of air raid victims may be carried out to the best advantage.

7.4 In keeping with local army and navy regulations, steps should be taken to provide protection of dispensaries by sandbags, or otherwise, from fragments and concussion of bombs.

H-8. Responsibilities of the Medical Services.

8.1 Frequent inspection of the yard by the medical staff shall be required in order that physicians may become familiar with shipyard jobs and thus help intelligently in preventing accidents and occupational disease.

8.2 Close collaboration shall be maintained with the safety department especially in regard to records of accidents and absenteeism.

8.3 It shall be the joint responsibility of the medical and safety departments through the supplies department to know the composition of paints, thinners, paint removers, and other chemicals used in the yard, and to see that the workers exposed are protected by the best safety practices.

8.4 As in the general practice of medicine the confidential relations of doctor and patient shall be maintained.

8.5 It is certain that in the near future women in large numbers are to be employed in the mechanical trades. It is necessary in shipyards to make special provisions for this class of patients. This will necessitate the establishment of separate waiting, treatment, and examining rooms. In yards where the number of employees is large, it may be logical to establish a separate dispensary for the handling of women patients.

H-9. Sanitary Inspections.

9.1 *Cafeterias and canteens.*—It shall be the duty of the medical department to adapt from Army and Navy standards, in reasonable conformity with the local health department rules, and inspection scheme to include preemployment examination of food handlers, quality and quantity of food, general cleanliness and comfort, screening, dishwashing, garbage and waste disposal. These inspections shall be made at unscheduled times and never less than once each week.

9.2 *Water supply, sewerage, and waste disposal.*—In cooperation with Maritime and Navy engineers the medical department shall inspect and report upon the above as often as seems advisable, but not less than twice yearly.

9.3 *Salt tablets.*—Salt tablets shall be made available to all employees and shall be kept in covered dispensers appropriately located.

H-10. Respiratory Protective Equipment for Shipyards.

The U. S. Bureau of Mines, 4800 Forbes Street, Pittsburgh, Penna., maintains a laboratory which tests and *approves* for use in industry respiratory protective equipment of all kinds. The Maritime Commission and Navy will require the use of *approved* equipment throughout all yards. The safety department shall be responsible for instructing men in the proper use of such equipment and for the maintenance of ample supplies.

10.1 Details of Bureau of Mines respirators with names of manufacturers, prices, and descriptions can be obtained from the Bureau or from the Maritime Commission.

10.2 The safety department shall be responsible to the management for cleaning and sterilizing all such equipment as often as may be agreed upon with the medical department. (A method for such sterilization is included in these standards; see section H-12.0)

10.3 *General requirements for respirators.*—

a. Adequate protection as defined by American Standard Safety Code for the Protection of Heads, Eyes, and Respiratory Organs. Handbook H-94, Nov. 1, 1938. Superintendent of Documents, Washington, D. C.; price 15¢.

b. Comfort (light weight and not obstructive to vision).

H-11. Jobs Requiring Respiratory Protective Equipment.

11.1 *Dust.*—

JOBS	PROTECTIVE DEVICES
Silica or Sand Dusts (as in sand blasting)	(1) Abrasive blasting helmets. (2) Dust respirator.
Lead Dust (as in mixing paint)	(1) Air line respirator. (2) Lead dust respirator.
Asbestos (as in covering pipes)	(1) Air line respirator. (2) Dust respirator.

11.2 *Metal fumes and smokes.*—

JOBS	PROTECTIVE DEVICES
Lead and zinc oxide from welding and burning.	(1) Air line respirator. (2) Fume respirator for lead. (3) Dust respirator for zinc oxide.

11.3 *Solvent vapors.*—

JOBS	PROTECTIVE DEVICES
Spray painting, both indoors and outdoors Paint removing, usually indoors Cementing, usually indoors Cleaning, usually indoors Degreasing, usually indoors	(1) Air line respirator. (2) Chemical cartridge respirator.

11.4 *Acid gases and mists.*—

JOBS	PROTECTIVE DEVICES
Pickling (indoors) Cleaning (indoors) Degreasing (indoors)	(1) Mist respirator. (2) Chemical cartridge respirator.

11.5 *Alkali mists.*—

JOBS	PROTECTIVE DEVICES
Cleaning (indoors) Degreasing (indoors)	(1) Mist respirator. (2) Chemical cartridge respirator.

11.6 *Asphyxiating atmospheres.*—

PROTECTIVE DEVICES

(1) Nose mask.
(2) Oxygen-breathing mask.
(3) All-service mask.

11.7 *Air supply for air-line masks of all kinds.*—Air at a comfortable temperature and free from odors and excessive moisture sometimes is difficult to furnish, especially for outdoor jobs in winter. Air quality and temperature shall be tested by the Safety Department and shall meet the suggestions of the American Standard Safety Code for air-supplied respirators (sec. 10.3a).

H-12. Sterilization of Respirators.

12.1 Each worker who needs a respirator should be assigned his own respirator. Where this is not done, it is important that the respirator be sterilized in addition to being cleaned. Adequate sterilization may be accomplished by—

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a. Washing the rubber and metal parts with soap, a brush and warm water, after which the respirator is sterilized by immersion for 10 minutes in a solution of formalin made by placing one part of 40 percent formaldehyde solution into nine parts of water.

b. Washing the rubber and metal parts with soap and warm water, after which the respirator is sterilized by dipping in a 3 percent solution of carbolic acid, a 2 percent solution of lysol, or a 70 percent solution of denatured alcohol.

c. Subjecting the respirator to sterilization by a moist atmosphere of antiseptic gas, preferably formaldehyde, for a period of ten minutes at room temperature.

d. After following any one of the outlined procedures, the respirator should be rinsed with water and hung up to dry. The respirator should not be used until it has been dried thoroughly.

e. The filters, felt screens, and elastic headbands should be removed, if detachable, before washing or sterilization of the respirator, unless it is evident that washing and sterilization will not harm these parts.

12.2 The National Safety Council has issued an Industrial Data Sheet No. D–Gen. 16, "Cleaning and Sterilizing Goggles and Respiratory Equipment."

H–13. A Guide for Prevention of Industrial Disease in Shipyards.

13.1 Eight common types of disease and methods for their prevention are given in the following sections. Help in applying these methods will be given by the local Safety Department and by safety and medical consultants of the Navy Department and the Maritime Commission.

13.2 *Flashburns and foreign bodies in the eye.*—

a. Effects on workers: "Flash" is a surface eye burn resulting from even momentary unprotected exposure to the welding arc. In this condition the eye is painful and sensitive, especially to light. An eye flash shall be treated only by the doctor or by methods he has prescribed.

b. Foreign bodies in the eye shall be removed only under the doctor's orders or by methods he has prescribed. Like flashburns, they are preventable.

c. For safe practice:

All workers:

1. Whenever near welding areas wear antiflash goggles which have been approved by the Safety Department.
2. Wear safety goggles when grinding, chipping, buffing, scratch-brushing, or forging.

Welders:

3. Wear approved antiflash goggles even when helmet is being worn.

4. Use portable screens to protect the eyes of fellow workers.

13.3 *Lead poisoning.*—

a. Sources: In general, any job in which dust, fume, or smoke from any substance containing lead is breathed daily.

b. For example:

JOB:	WHEN MATERIAL IS:
Welding	Metal, coated with paint containing lead.
Cutting	
Burning	Lead.
Shrinking	Lead pigments.
Grinding	
Buffing	
Spray painting	
Mixing paint pigments	

c. Job can be done safely with:

1. (a) Special ventilation: Use a local exhaust hood approximately 8 inches from the job and drawing at least 200 c. f. m. into the hood with filtration of the discharge, or discharge, to a place where the contaminated air will not be breathed, or
   (b) Wearing of fume respirators, or
   (c) Wearing of supplied air respirator.
2. Periodic medical examination which includes blood and urinalyses.

13.4 *Solvent vapors.*—

a. Sources: In general, any job in which solvent vapors are breathed. For example:

Spray painting.
Painting.
Using paint remover.
Applying cements.
Paint brush and spray gun cleaning.

b. Job can be safely done with:

1. Segregation of such work, and
2. (a) Special ventilation as may be required.
   (b) Provision of spray booths with exhaust system.

(c) Wearing of special respirators:
(1) For spray painting: Supplied air respirators or air line hoods.
(2) For other jobs: Chemical cartridge respirators.
(See H–10 on respiratory protective equipment.)

13.5 *Zinc fume fever (zinc chills or shakes).*—

a. Sources: In general, any job in which the fumes from heated zinc are breathed. For example:

JOB:	WHEN MATERIAL IS:
Welding	Galvanized metal
Cutting	Zinc
Shrinking	Zinc alloy
Pouring zinc alloys	Brass

b. Job can be safely done with:

1. Special ventilation: Local exhaust hoses or hoods located close enough to operation at all times to remove smoke completely.
2. Wearing of special respirators.

NOTE.—There are no known cumulative effects from zinc chills.

13.6 *Fiberglas.*—

a. Effects on workers: Men working with Fiberglas may develop a dermatitis or conjunctivitis which are skin and eye conditions. It is best to transfer to another job those who continue to be sensitive.

1. Both experimental and practical evidence show conclusively that the inhalation of Fiberglas causes no lung damage.
2. The cement used with Fiberglas may contain a toxic solvent such as carbon tetrachloride (CCl_4) which can cause severe illness or even death if the cement is used indoors with inadequate ventilation.

b. For safe practice:

1. Clothing: Supply loose coveralls with collars and sleeves buttoned over cheesecloth.
2. Goggles: Should be worn.
3. Shower: Should be taken rather than bath, at end of shift.

Respirators are usually not necessary, *but* if a cement containing a toxic solvent is used, proper protection either by ventilation or by a respirator must be supplied and used.

13.7 *Asbestosis.*—

a. Sources: In general, any job in which asbestos dust is breathed. For example:

JOB:	WHERE MATERIAL IS:
Handling.	Asbestos
Sawing.	Asbestos mixtures.
Cutting.	
Molding.	
Welding rod salvage.	

b. Job can be done safely with:

1. Segregation of dusty work and,
2. (a) Special ventilation: Hoods enclosing the working process and having linear air velocities at all openings of 100 feet per minute, or
   (b) Wearing of special respirators.
3. Periodic medical examination.

13.8 Silicosis.—

a. Sources: In general, any job in which the dust of free silica (sand) is breathed daily. For example:

JOB
Sand-blasting
Sand packing of pipes
Shot blasting of castings

b. Job can be done safely with:

1. Isolation of dusty process and, in addition,
2. Special ventilation: In the case of sand-blasting, the work should be done in the standard type of sand blast room, cabinet, or machine.
3. Special respirator for dust-containing free silica.
4. Periodic examination by doctor.

13.9 Dermatitis.—

a. Sources: Excessive or improper use of cleaning agents such as gasoline. It is not at all uncommon to find dermititis caused by excessive use of common soaps such as those used in laundering. Cutting oils, certain greases, certain insulating materials used on electric cables and conduits can cause dermatitis.

b. Job can be done safely with:

1. Precautions against excessive use of the causative agent.
2. Advice of the medical department in the use of protective salves and creams.

H-14. Ventilation Standards.

14.1 Ventilation is required to control temperature and to remove air impurities, as from welding and paint spraying.

14.2 The maintenance of proper working conditions shall be the responsibility of the safety department, whose staff shall work in close cooperation with the welding, paint, and electrical departments. Air analyses and tests shall be made by the safety and medical consultants of the Navy Department and the Maritime Commission as may be needed.

14.3 Personnel of Department.—

a. Number:

1. The size of the ventilation crew will vary with the type of ship, equipment available, etc. The head of the safety department will be responsible for the organization of the safety department or division.
2. There shall be a ventilation supervisor on each shift responsible to the head of the safety department. Under the supervisor there shall be a sufficient crew to inspect and maintain good working conditions.
3. An EC-2 ship shall have at least one ventilation man aboard. Larger ships, or ships like carriers with considerable galvanized welding, shall have at least two ventilation men.
4. The number of ventilation men on the night shifts shall be in proportion to the construction crews.
5. The ventilation crew must have available a maintenance and repair crew of sufficient size to keep equipment on the job and operating efficiently. Long waits during which equipment is idle must be avoided.

b. Training:

1. The ventilation supervisor (that is, the safety engineer) shall be trained to handle the entire ventilation program in the yard. Local educational institutions, State Industrial Hygiene Units, Maritime Commission engineers, and other sources are available to give this training.
2. The ventilation supervisor shall organize classes, demonstrations, and short talks on standard procedures for ventilating specific spaces on the ships.

14.4 *Type of equipment needed.*—In ship construction, two types of ventilation are used—local exhaust as for removal of welding fumes at the point of origin, and general ventilation to supply fresh air to confined working spaces.

a. Local exhaust:

1. A common length for a local exhaust hose is forty feet. In ordering exhaust fans for use with local exhaust hoses, the following specifications should be met: Capable of drawing a minimum of 200 c. f. m. through each of 3-inch (or 4-inch) diameter flexible hose. Fans should have provisions for attaching three or more local exhaust hoses per unit.
2. In the interests of power economy, it is undesirable to move much more than 200 c. f. m. through each local exhaust hose.

b. General ventilation:

1. It is frequently desirable to introduce air into large working spaces such as deep tanks, fore- or after-peaks. This is done in many yards by using a flexible fabric duct, with metal elbows, and a fan of about 5,000 c. f. m. capacity.
2. It is desirable sometimes to supply a quantity of fresh air into the double bottom. Here a 2,000 c. f. m. unit may be used.
3. These two examples represent the two extremes of this type of work, and therefore are the two extremes in fan sizes. Fan static pressures in each case should exceed four inches of water.
4. For general ventilation of a ship engineroom during construction, a 10,000 c. f. m. blower is recommended. On the other hand, operations in confined quarters where heat is generated (plate shrinking, for example) may use a small portable fan to circulate the air. For this purpose, small blowers of from 800 to 1,500 c. f. m. shall be provided.

c. Ventilating procedures:

1. Local exhaust shall be used whenever a welding operation is being conducted in a confined space, or whenever galvanized metal is being welded. Local exhaust is always a suction process. Never blow a stream of air upon a welding arc.
2. Many welders think that it is enough to hold the end of the suction hose in the same compartment with the welding operation. This is not so. In order to capture the welding fumes, the end of the hose must be within six or eight inches of the arc, assuming a 200 c. f. m. volume per hose. Beyond this distance, the suction hose is ineffective.
3. The air supply to a general ventilation fan must be fresh outside air. Recirculation of air already contaminated shall not be permitted. A minimum of 400 c. f. m. per welder shall be supplied to a given working space such as a deep tank when general ventilation is used alone.

4. In warm weather, air movements or drafts are helpful, while in cold weather a minimum of air movement is desired and local exhaust will serve best. In temperate weather, it is most satisfactory to use a combination of local exhaust and general ventilation.

14.5 *Coordination of department with construction program.*—

a. The ventilation supervisor shall keep abreast of construction, and thus anticipate the ventilation needs.

b. The construction foremen shall inform the ventilation department of ventilation needs before the needs occur.

c. Blackboards, boxes, signal lights, or similar devices shall be installed on board and used to inform the ventilation department of immediate needs.

14.6 *Supplementary ventilating procedures.*—

a. Ventilating confined spaces, such as the fore- or after-peaks and deep tanks, is greatly simplified by the temporary removal or cutting through of certain plates.

b. For example, the fore-peak of a Liberty ship can best be ventilated by cutting a combination access and ventilation hole through the watertight bulkhead near the ship's bottom.

c. The tank top can be left off of the midship deep tanks until all welding has been completed in this space.

d. A side plate can be left or cut out of the engineroom at the bottom deck level.

MINIMUM REQUIREMENTS FOR SAFETY

S-2. Managements Part.

2.1 It is absolutely essential, if a successful accident-prevention program is to be installed and operated, that top plant management take an active and interested part in the work. The same supervision given any other important activity in the shipyard shall be given the safety program.

2.2 The responsibility of management insofar as industrial safety is concerned shall be considered to include—

2.21 The provision of a safe working environment.

2.22 Training of employees for safety.

2.23 Establishment of an accident record and reporting system which will definitely tie into nationally uniform reporting, record, and statistical requirements.

2.24 The appointment, where necessary, of a safety engineer (or a safety director) and staff to install, maintain, and properly supervise an accident-prevention program.

2.25 The issuance of instructions to all division or department heads, foremen, leaders, leadingmen and to any persons in supervisory capacity, that they are considered responsible for preventing accidents which involve employees working under their direction and requiring them to comply with all of the provisions of the accident prevention program in effect in the shipyard.

2.26 An active and interested participation in safety through—

(a) Review of, and executive action on, safety records.

(b) Regular attendance at safety meetings.

(c) Action upon good or bad departmental safety records through personal interviews with department heads.

(d) General letters, for bulletin board posting, addressed to employees and discussions of good or bad yard accident record.

(e) By setting a good example. (Goggles, safety shoes, hard hats and other necessary protective equipment shall be used by any executive who exposes himself to yard operations.)

S–3. Safety Director and Staff.

3.1 A full-time safety director (title may be safety engineer or safety inspector, etc.) and staff shall be appointed for all shipyards. (See Section 3.25 for duties and responsibilities.) The safety director shall report to, and be responsible to, the highest ranking managerial executive or his designated representative.

3.2 The staff in the safety department in addition to the safety director, shall consist of:

3.21 An assistant safety director in yards having 3,000 employees or more except that there shall always be at least one safety engineer per shift.

3.22 One safety engineer (safety inspector) for each additional 1,500 employees. Example: If a yard has 35,000 employees there would be required a safety director and an assistant plus 21 safety inspectors.

3.23 The staff of engineers shall be distributed over the three shifts in proportion to the number of employees on each shift.

3.24 One clerk and/or stenographer for the first 5,000 employees and one clerk for each additional 7,500 employees. (It is not to be assumed that the time of safety inspectors or the safety director can be spent on clerical detail. All office functions, while adequately supervised by the safety

director, should be carried on by clerks so the greatest possible amount of time of the safety director and his staff may be spent in the shipyard.)

8.25 The duties and responsibilities of the safety director shall include:

(a) Complete responsibility for formulating, administering and making necessary changes in the shipyard accident prevention programs within the limits of authority granted by the shipyard management. The safety director shall also be required to correlate the shipyard accident program with the minimum safety and health standards of the United States Navy Department and Maritime Commission.

(b) Submission of regular monthly, weekly or daily reports on the status of safety directly to the general manager or his designated representative.

(c) Acting in an advisory capacity on *all* matters pertaining to safety to the management, general manager, superintendents, foremen, quartermen, leadermen, purchasing department, engineering department, commissary department, or contractors.

(d) Maintenance of the accident record system, making all necessary reports, personal investigation of all fatal or serious accidents, investigation through his staff of all accidents, securing supervisor's accident reports, checking corrective action taken by supervisors to eliminate accident causes.

(e) Supervising, or closely cooperating with the training supervisor in the safety training of all employees. (See Section 6.26.)

(f) Correlating safety work with medical department to insure proper selection and placement of employees.

(g) Making personal inspections and supervising inspections by staff and by special employee committees, for the purpose of *discovering and correcting unsafe conditions or unsafe work practices BEFORE THEY CAUSE ACCIDENTS.*

(h) Exchanging information with other shipyards on best safety methods and consulting with United

States Navy Department and Maritime Commission Regional Safety Consultants on safety problems which cannot be solved with methods or information at hand.

(i) Making certain that all federal, state or local laws, ordinances or orders bearing on industrial safety are complied with.

(j) Securing any necessary help or advice from the state labor departments on matters pertaining to safety and health.

(k) Initiating activities that will stimulate and maintain the interest of employees in safety.

(l) Acting as secretary of all safety committees and in such capacity he shall prepare an agenda for each such meeting covering the business to be discussed and, he shall prepare for the record, minutes of each such meeting.

(m) Directing the activities of his staff including the assistant safety director, so that the shipyard accident prevention program will be efficiently operated. It is expected that the safety director may delegate certain responsibilities to his staff engineers, such as that of acting as secretary of certain of the safety committees. Permission for such delegation of authority is expressly given in the interest of efficiency and for training the safety staff.

(n) Submission of the required reports on the status of safety in the shipyard to the interested government agencies at the time and intervals hereinafter requested.

S-4. Accident Prevention Forms and Reports.

4.1 The safety director shall cause to be designed and put into use at least the following forms and records:

4.11 *Supervisor's report of accident.*—

(a) Giving all vital data on case plus statements as to unsafe act and/or unsafe condition, reason unsafe act or condition was permitted to exist or occur, and the immediate corrective action taken or recommended. (See Form 1.)

4.12 *Safety engineer's recommendation form.*—

(a) Form used by safety staff to record recommendations made during inspection. Used for follow-up. Made in triplicate; one to leader-

Budget Bureau No. [illegible]
Approval expires January 31, [illegible]

U. S. MARITIME COMMISSION — U. S. NAVY
PRIVATE SHIPYARDS
SUPERVISOR'S REPORT OF ACCIDENT OR OCCUPATIONAL DISEASE

Fill out for every disabling injury (or case of occupational disease) whether or not compensable. Answer every question fully. Use other side if necessary. To be mailed with the Monthly Injury Summary (for the month covered in that report) by the 15th of the following month to the Division of Industrial Injury Statistics, Bureau of Labor Statistics, Washington, D. C.

(1) Name of yard ______________________ (City) ______ (State)

(2) Name of injured employee ______________________ Badge No. ______

(3) Occupation ______________________ Department ______

(4) Date of accident ______________________ Hour of day ______ a.m. ______ p.m.

(5) Witnesses: Name ______________________ Badge No. ______

" ______________________ " " ______

(6) Describe accident or case fully (what injured was doing, what happened, etc.) ______

(7) What unsafe condition caused accident or occupational disease? (Specify: broken ladder, defective staging, lack of ventilating equipment, etc.)

(8) What was done wrong (unsafely) that caused accident or occupational disease? (Specify: failure to wear provided goggles, overloading crane, using mushroomed chisel, failure to use respiratory protective equipment, etc.)

(9) Describe resulting injury or occupational disease. (Specify: lacerated hand, broken left leg, right thumb amputated, lead poisoning, etc.)

(10) What have you done to prevent similar occurrences? ______

(11) What do you recommend to prevent similar occurrences? ______

(12) Signed by: ______ Title: ______ Date: ______

Checked by: ______

DO NOT USE

Serial No. ______
Code date ______
Region ______
Location ______
Occupation ______
Dept. ______
Injury date ______
Time of day ______
Agency ______
Agency part ______
Uns. mech. cond. ______
______
Acc. type ______
Uns. act ______
Uns. pers. fact ______
______
Injury ______
Body part ______

FORM 1. (See paragraph 8. 411-a.)

SAFETY ENGINEERS RECOMMENDATION FORM

BLANK SHIPBUILDING COMPANY

To:_____ Location _____

Date_____ Time_____

An inspection of operations under your supervision revealed the following unsafe practices and/or conditions:

NOTE: (Unsafe acts or conditions to be described here and numbered. Badge numbers or names of men involved may be listed.)

Above conditions or practices last observed (1)_____ (2)_____ (3)_____

Corrected at once?_____ If not, when will corrective action be taken?_____

Signed_____
Safety Department

Date checked_____

(Used only if condition is not corrected at once.)

Signed_____
Safety Department

No. 000

NOTES: (1) Size, approximately 5" x 5"

(2) To be made out in triplicate (Sec 4.12)

(3) Form need not be filled out if condition is corrected at once unless unsafe act or condition is a repetition or a flagrant violation of safety rules is involved.

(4) If check shows existence of some unsafe act or condition the matter should be referred in writing, to the proper executive for action.

man or quarterman on job, one to general manager, or other designated executive, one to safety department files after use to check performance. (See Form 2.)

4.13 *United States Navy Department and Maritime Commission monthly injury summary.*—

(a) To be submitted monthly to United States Navy-Maritime Commission. (See Form 3 attached.) To include over-all breakdown of predominant accidents, types and causes, accident frequency, total number of fatal cases, total of lost-time cases and the time lost, etc. *This form to be used also for report to management of shipyard.* To be submitted in triplicate as required on form. (See Form 3.)

(b) The following formula shall be used in determining accident frequency rates for shipyards:

1. Accident Frequency =

$$\frac{\text{Number Disabling Injuries} \times 1{,}000{,}000}{\text{Total Man-Hours Worked for Period Covered}}$$

2. A disabling injury shall be considered to be any injury which results in a man being unable to report for work on the next regular day or shift after the accident, or one which calls for a standard time charge being made regardless of whether time is actually lost. If time is lost due to the injury, subsequent to the initial return to work, then the injury shall be accounted as disabling.

4.14 *Minutes of safety committee meetings.*—

(a) Minutes of meetings should show date and time of meeting, names of those present, action on unfinished business, brief description of new business discussed and action taken or ordered by the committee on each item. The discussion should always include the predominating accident hazards of the yard and the means suggested to control them.

(b) Various committee forms will be made available to shipyards on request.

4.17 These forms and any others pertaining to industrial safety or health shall be filed and made available to authorized

U. S. MARITIME COMMISSION — U. S. NAVY
PRIVATE SHIPYARDS

INJURY SUMMARY FOR MONTH OF _____, 19__

1. Name of company _____
2. Location of shipyard _____ (Name) _____ (State)

EXPOSURE DATA

3. Average number of employees _____ 4. Total employee-hours worked during month _____
(Include normal employees and supervisors)

INJURY DATA

Disabling injuries

	Number		Days Lost	
	Occurred during month (1)	Of those during this or previously reported (2)	For injuries during month (3)	For injuries previously reported (4)
5. Fatalities				X X X
6. Permanent impairments				
7. Temporary total				
8. TOTAL		X X X		
9. Non-disabling injuries		X X X	X X X	X X X

10. Frequency rate _____ Total number of disabling injuries (Item 8) x 1,000,000 / Total employee-hours worked (Item 4)

11. Yearly frequency rate to date _____

Comments: _____

Report made out by: _____ Title: _____ Date: _____

INSTRUCTIONS

1. A disabling injury is one which results in death, permanent impairment (through amputation or loss of use of any body part), or loss time beyond the day or shift on which the injury occurred.

2. Show in column (1) [of Injury Data] the total number of injuries which occurred during the month, and in column (2) the number of injuries which were determined to be more severe than previously reported. For instance, there is a disabling injury formerly reported as a temporary impairment of the injury resulted in death during the month covered by this report, and explain briefly under "Comments."

3. In column (3) show the actual days lost during the month because of injuries which occurred during the current month. In column (4) show the number of days lost during the current month because of injuries which were reported in previous months. Do not use A.M.A. time charges for double or permanent impairments. For fatalities show the number of days which elapsed between the day of injury and death (i.e., if death occurs on the 2nd day of injury show as time lost). For permanent impairments show the number of days during which the injured person was unable to work.

(Over)

Form 3-Front. (See paragraph E. 4.13-a.)

ACCIDENT CAUSE ANALYSIS FOR THE MONTH

Unsafe condition or practice (If more than one item applies, give preference to the one appearing first on the list)	Disabling injuries — Total: This month	Disabling injuries — Total: Year to date	Disabling injuries — Resulting in infection during the month
a. Lack of goggles or screens — eye injuries only			
1. No impact goggles			
2. No anti-flash goggles under hood			
3. No welding screens			
4. No welder's hood			
5. Other (specify)			
b. Improper method of handling material			
1. Lifting with back bent, poor grip, etc.			
2. Insufficient help in lifting			
3. Failure to use crane, hoist, etc.			
4. Failure to wear safety shoes			
5. Failure to wear gloves			
6. Other (describe)			
c. Poor housekeeping resulting in falls			
1. Unguarded openings, holes, pits, etc.			
2. Defective ladders, staging, etc.			
3. Unsafe use of ladders, staging			
4. Poor housekeeping generally			
5. Other (specify)			
d. Poor housekeeping — all other injuries			
1. Poor layout			
2. Poor housekeeping generally			
3. Other (specify)			
e. Improper condition or use of hand tools			
1. Unsafe condition of hammers			
2. Unsafe use of hammers			
3. Defective chisels — hand and air			
4. Unsafe use of chisels — hand and air			
5. Other (specify)			
f. Improper condition or use of welding and cutting tools (except eye injuries)			
1. Lack of ventilating equipment			
2. Improper use of ventilating equipment			
3. Defective cables of electric welding equipment			
4. Defective electric welding equipment			
5. Improper use of electric welding equipment			
6. Defective gas welding or cutting equipment			
7. Improper use of gas welding or cutting equipment			
8. Other (specify)			
g. Improper placing or piling causing falling objects			
1. Placing insecurely on staging			
2. Placing insecurely elsewhere			
3. Other (specify)			
h. Defective or unsafe use of machinery			
1. Unguarded power presses			
2. Unguarded or defective abrasive wheels			
3. No goggles or shield when using abrasive wheels			
4. Failure to adjust rest — abrasive wheels			
5. Defective or unguarded chains, rolls, brakes			
6. Other (specify, as overhead cranes, etc.)			
i. Defective or unsafe use of cranes and hoisting equipment			
1. Defective slings			
2. Defective pads, ropes, chains			
3. Unsafe hooking or rigging of load			
4. Standing under or near suspended load			
5. Other (specify)			
j. Improper protection against spray painting			
k. Improper protection against sand blasting			
l. All others			

representatives of the United States Navy-Maritime Commission upon request.

S-5. Safety Committees.

5.1 The safety director, in cooperation with the shipyard general manager, shall cause to be formed and put into effective operation at least the following safety committees.

5.11 *Central safety committee.*—

(a) Membership: management representative (chairman), safety director (secretary), all superintendents, foremen, medical department representative, quartermen or leadermen, and one employee.

(b) Membership of all but management representative, medical department representative and safety director may be rotated—terms of 2 months each but rotation to be arranged so only ½ of committee changes each month.

(c) Meetings: Shall be monthly or more often as necessary.

(d) Duties: This is the policy forming committee for safety work. They review the monthly report as submitted to the United States Navy-Maritime Commission and other records to determine the course of safety work for coming period. They decide such matters as type of safety equipment to be used and how it shall be made available to men, types of safety training to be used, whether accident prevention plan is being adherred to, interplant contest awards, etc. Such committees shall review the investigation on fatal or serious accidents and make recommendations. All Committee members are expected to make practical suggestions to improve shipyard safety. They also review reports of other committees to make certain suggestions and recommendations are properly followed through.

(e) Secretary: The safety director shall act as secretary, prepare an agenda, take minutes, prepare a report of committee meeting, and distribute copies of reports to members. He shall follow through with other committees, the suggestions and recommendations of the central safety committee.

5.12 *Supervisors' safety committee.*—

(a) Membership: Management representative, safety director, medical department representative, superintendents, foremen, quartermen, and leadermen. This is a rotating committee; rotation should be arranged so all of the supervisory staff serve in their respective periods, i. e., superintendents change each four months, foremen each two months, quartermen and leadermen each month. In no case should an entire group change at one time. Where a department or unit of a department has an unusually poor record then the responsible supervisory staff—superintendent, foremen, quartermen or leadermen should be retained on the committee until their record is at least equal to the shipyard average.

(b) Meetings: Shall be monthly or semimonthly or more frequently, as necessary.

(c) Duties: The primary purpose of this committee is the stimulation and maintenance of interest and the education of its members in accident prevention. The shipyard accident record shall be reviewed, the predominant types of accidents and the predominant causes of these accidents shall be discussed. Suggestions and recommendations to improve the records are solicited from each member. At least one timely subject must be discussed at each meeting; i. e., such as eye injuries and their prevention, electric shocks, hand tool accidents, etc. Methods of avoiding accidents due to these operations should be presented by the committee members.

(d) The committee shall review reports of all fatal and serious accidents and suggest preventive action. It shall review reports of inspection committees and check on the quality of the suggested corrective action for unsafe conditions or practices reported.

(e) The committee shall carry out the suggestions and recommendations of the central committee.

(f) Outside speakers such as safety engineers, insurance men, State Department of Labor men or men from other shipyards, may be used from

time to time to stimulate interest of committee members in accident-prevention work. Sound film strips, motion pictures or other similar media on safety subjects can and should be used if available and practicable.

(g) Secretary: Same as for central safety committee.

5.13 *Regular inspection committees.*—

(a) Number: One committee for each department and each hull.

(b) Inspection: Weekly or more often as necessary.

(c) Membership: At least two employees and a supervisory employee of each job being inspected. The safety director or staff safety engineer should accompany the committee.

(d) Duties: To inspect their department or hull for the purpose of discovering and having corrected unsafe acts and unsafe conditions likely to cause accidents. On each section of a job they should be accompanied by a responsible supervisory employee. They are observers only—the foremen, quartermen or leadermen shall do all corrective work. Where a condition is discovered on which there is disagreement the superintendent shall make the necessary decision. *Hazards immediately dangerous to health, life or limb shall be corrected by the accompanying supervisor at once.*

(e) The committee shall submit written reports to the safety director and indicate whether accident-producing conditions or practices have been corrected. These reports shall be referred to the supervisory safety committee by the safety director. If necessary because of dangerous conditions, he may refer them at once to the general manager.

5.14 *Special inspection committees.*—

(a) Staging inspectors, electrical inspectors, crane inspectors, boiler inspectors, and others.

(b) Membership: Specially qualified individuals or teams permanently assigned to work. (See paragraph 5.15c.)

(c) Duties:

1. Staging inspectors: Daily or continuous inspections of all stages shall be made on each

hull—or other locations where stages are used. Report shall be made of all defects to the responsible supervisor for immediate correction. Copy of the daily report shall be submitted to the safety director.

2. Crane inspectors: Weekly inspections shall be made of all cranes and rigging. Reports shall be submitted to proper department heads for correction of unsafe conditions or practices. Copies of reports on defects shall be made to the safety director.

3. Other inspectors: As above and at indicated frequency.

5.15 *Safety committees—General.*—

(a) Committees in addition to those specified in these standards, may be formed and operated if desired.

(b) Representatives on all committees, when of a supervisory status, should be appointed by the shipyard general manager and held responsible by him for active and interested participation in the work of the committee. Employee representation may be secured in the same manner, or by appointment of employee committees, union shop stewards or by election of union members or by any other feasible means.

(c) The services of production employees having related duties may be taken advantage of on inspection committees. Stage erectors or repair men may serve as permanent and continuous staging inspectors, a man or men from the ventilation crew may be utilized for checking on ventilation practices. The reports of state or insurance inspectors will be considered adequate on boilers, air compressors and receivers or on other pressure vessels.

3-4. Employee Safety Training.

6.1 The time for the safety training of an employee to start is at the inception of his employment. After a physical examination, which should be made to make certain that the employee is physically capable of performing safely the work he is requesting, the man shall have explained to him the safety policy of the company by a representative of the safety department. This may be done individually, in general groups or in craft groups and the instruction may

be supplemented by printed instructions in the form of rule books or instruction cards.

6.2 Employees shall have in their possession, and be instructed in the proper use of, all necessary personal protective equipment before being started on any job.

6.3 General safety rule books, craft safety rule books or safety instruction cards should be supplied employees. Such books should be concise but complete enough to furnish written record of all important safety rules. *No rule shall be included which will not be strictly enforced.* The assistance of United States Navy-Maritime Commission safety engineers will be given in the preparation of such rule books if desired.

6.4 All employees shall be instructed in their specific duties by their immediate supervisor and they shall be made familiar with the hazards of the job and instructed carefully in how to avoid them. It shall further be the duty of the supervisor to constantly check all employees so unsafe working practices may be corrected before accidents occur.

6.5 Safety instruction shall be correlated with all apprentice and craft training schools. Safety instruction in such schools or training courses shall include an explanation and demonstration of the need for the safety equipment or safe practices specified and the strict enforcement of all safety requirements in the classes. The instructors shall, by their own example, impress upon the learners the importance of the safety requirements.

6.6 Safety bulletin boards shall be located at each hull and shop, and at such other locations where they may be desirable, on which safety posters, letters or bulletins from the shipyard management or safety department and other safety material may be posted.

6.61 The bulletin boards shall be located where the majority of the employees at a particular location will see them.

6.62 The bulletin boards shall be well constructed, have a locked glass cover and shall be lighted at night.

6.63 Safety posters and other material on bulletin boards shall be changed at least semimonthly or more often. (Posters will be made available by the United States Navy-Maritime Commission for the use of shipyards. However, posters may be selected by the shipyard safety department from any source.)

6.7 Where shipyard house organs (magazines or newspapers) are established, the safety director shall arrange to have a reasonable proportion of the space devoted to safety (articles, items and cartoon cuts relating to safety will be made available by United States Navy-Maritime Commission safety consultants.)

6.8 Sound-film strips and motion pictures on safety subjects should be used where practicable. Public address systems, where installed, may be used for safety messages to shipyard employees especially during lunch hours or at shift changes.

S-7. Safety Supply Store.

7.1 A safety supply store shall be established in each shipyard where safety shoes, safety hats, protective impact goggles and filter-lens welding goggles shall be made available to shipyard workers. Shoes may be sold at or near cost to employees, but safety hats and impact and filter-lens goggles shall be issued to each employee but shall remain the property of the company to be returned when the employee ends his employment. Equipment such as work clothes, gloves, welders helmets, may also be stocked and sold to employees if desired.

7.11 Goggles may be stocked in the central tool room or first-aid department but should be fitted as described in paragraph 7.2 following.

7.2 The attendant of the safety store should be skilled in fitting safety shoes, and if goggles are also issued, he should be trained in proper fitting and servicing of goggles.

S-8. Goggles.

8.1 Impact-resisting goggles of a type suitable for the particular job and also of a type meeting the requirements of the United States Bureau of Standards, shall be worn by every employee exposed to the hazard of eye injuries. Practically every employee in the shipyard, with the exception of those working inside offices at all times are either directly exposed to eye injury from the work they do, or indirectly through working near operations which are likely to produce flying objects. (See paragraph H-10.3a, page 4.)

8.2 Except where *temporary* lack of goggles make it impossible, each employee shall have his own pair of goggles. If it is necessary to reissue goggles to different employees, *the goggles must be sterilized after each use.*

8.3 Goggles supplied employees should be carefully fitted to their face to prevent irritation and to prevent the entrance of foreign objects around the edges. (See paragraph 7.2.)

8.4 All employees working in proximity to arc-welding operations shall be required to wear anti "flash" goggles, of at least No. 2-5 shade (or equivalent), of a type meeting the requirements of the United States Bureau of Standards. (See section 9.1 on welding for additional eye protection for welders.)

8.5 Welding screens constructed of wood, metal or other suitable material shall be used to protect the eyes of workers in proximity to electrical welding operations, whenever their use is practicable.

S-4. Welding—Arc.

9.1 All welders shall be made familiar with the hazards of their work and instructed in safe methods of performing the various types of jobs to which they are assigned.

9.2 Personal protection equipment used by welders shall include:

9.21 Welders' protective hood provided with the proper shade of filter type lens for protection against the harmful rays of the arc and a clear cover glass to protect the filter lens.

(a) The shades or their equivalent recommended are:

Up to 30 amperes—No. 6-7 Shade.
30 to 75 amperes—No. 8 Shade.
75 to 200 amperes—No. 10 Shade.
200 to 400 amperes—No. 12 Shade.
Over 400 amperes—No. 14 Shade.

(b) Shades may also be selected from the following table:

Rod diameter	Welding glass shade No.
1/16	10
5/32	10
1/8	10
5/32	10
3/16	12
7/32	12
1/4	12
9/16	14
5/16	14

(c) The welder's hood should be inspected at least weekly to detect possible light leaks, cracked protective glass, or badly fouled or missing cover glasses. Any defects discovered shall be corrected at once.

9.22 Protective leather welders' jacket, long-sleeved wool shirt with buttoned collar and leather welders' glooves and safety hat.

(a) It has been found satisfactory in the hot summer months to substitute flameproofed cotton shirts. If this is done, the flameproofing, which must must be reapplied after each washing, should be done under the direction of the shipyard. This entails that laundering also be done by the company. Commercial laundries are rapidly undertaking this type of work.

9.23 Hardened and filter lens protective goggles with sideshields to be worn under the hood for protection against harm-

ful rays where the hood is raised and for protection against flying scale and chips. The goggles should be of a type meeting the requirements of the United States Bureau of Standards and of at least No. 2-4 shade or equivalent.

9.24 Safety shoes or pull-on boots with cord or leather soles and heels.

9.3 Welding screens (constructed of flameproofed fabric on wood or metal frames, metal on metal frames, or plywood sheets joined by rings) of a size sufficient to protect men working nearby from the harmful effects of the electric arc rays shall be used on all electric welding operations when practicable.

9.31 A type found very successful by one large company can be economically constructed of ¼" to ⅜" plywood. Two pieces about 18" x 30" are joined at two points along one edge with 2" x ⅛" rings. The large size of the rings allows the two pieces to lap sufficiently to make a lightproof joint, while the light weight of the assembled screen makes men more prone to use them.

9.4 Welding leads shall be inspected at least once each shift, and those found defective shall be repaired or replaced.

9.5 All welding leads should be coiled back to centrally located stations after the completion of each shift or job.

9.6 Welding rod tips should not be thrown on decks or stages but should be retained by the welder and turned in at the end of the day for salvage.

9.7 Each electric welder shall make an inspection of the area below him, and of the opposite sides of bulkheads on which he is working, to make certain that there is no danger of falling or penetrating sparks causing a fire. He and his helper must know the location of fire extinguishing equipment and how to use it. It is recommended that a fire extinguisher be available in the immediate area.

9.8 The safety of women welders presents several special problems which should be carefully considered while women are being trained and during their first several weeks on the job.

9.81 Women will at first be subject to excessive fatigue because they are unaccustomed to shipyard work. In their enthusiasm they are likely to overdo and will, under such conditions, be more prone to accidents and at the least, absences may follow. They should, until they become accustomed to the work, be carefully watched by supervisors and if signs of fatigue are evident they should temporarily be given lighter work.

9.62 Work clothing for women is still in the development stage. In general, however, the following should be observed:

(a) Safety shoes or pull-on boots with cord or leather soles and heels.

(b) Long underwear, union suit type (wool for winter) khaki trousers and shirt, or coverall type of overall with a drop seat and welders' leather uniform.

(c) It is desirable that the outer clothing, unless of wool, be flameproofed.

(d) Leather gloves.

9.63 Whenever possible, mechanical means of handling material should be utilized in preference to manual handling.

S-18. Burners.

10.1 Equipment for burners shall be the same as that for welders except that the leather clothing and welders' helmets need not be worn. Filter type lens protective glasses with side shields. No. 3–6 shades or their equivalent should be worn. Flameproofed clothing is desirable.

10.2 All individual oxygen and acetylene and other gas lines shall be turned off at the manifold at lunch hour and at quitting time or if the burner must leave the immediate vicinity of his work during the regular shift.

10.3 All hose should be coiled up to the manifold when shifts are changed or when jobs are completed.

10.4 The practice of dusting the clothes by blowing oxygen on them or using oxygen for ventilating or cooling purposes has resulted in several fatalities and *shall be absolutely forbidden*. Oxygen shall be used only in connection with burning or welding operations.

10.5 Each burner shall make an inspection of the area below him, and of the opposite sides of bulkheads on which he is working, to make certain that there is no danger of falling sparks causing a fire. He and his helper should know the location of fire-extinguishing equipment and how to use it. It is recommended that a fire extinguisher be available in the immediate area.

10.6 Burners' uniforms (overalls) shall be laundered at least weekly except that if oil or grease is spilled on the clothing, it shall be changed at once. It is desirable that arrangements be made by the company to have uniforms (overalls) laundered and flameproofed.

10.7 Defective burning equipment such as torch, hose or cylinder pressure regulators (where cylinders are used), shall be repaired immediately.

10.8 All oxygen and acetylene (gas) lines shall be inspected at least once each shift and those found defective shall be repaired or replaced.

10.9 Standard color coding for oxygen and acetylene pipe lines shall be observed for oxygen and acetylene. (Since it may be impos-

sible to secure colored hose during the war, identification may be made by any practicable means so long as every burner and burner's helper or any other person who has occasion to use oxygen-acetylene (gas) equipment is thoroughly familiar with it.)

S-11. Cranes (Whirleys, Hammerheads, Bridge, etc.)

11.1 The safe loads as specified for cranes on single lift shall not be exceeded.

a. For the guidance of crane operators, weights of all sections over 5 tons shall be plainly marked on the section in figures at least 12 inches high.

11.2 On double lifts, cranes shall not be loaded to more than 75% of their combined rated capacities.

11.3 All crane operators shall be given a thorough physical examination upon employment and at at least yearly intervals thereafter. Particular attention should be given to the eye examination.

11.4. Crane inspectors. (See section S. 5.14.)

11.5 All whirley and hammerhead cranes shall be provided with bumper guards of ¾" wire rope or equivalent set from 32 to 36 inches from the ground, and fastened in the form of a half loop to all four wheel covers at the leading and trailing ends of the crane.

11.6 All traveling cranes regardless of the type shall be equipped with a clearly audible automatically operated signal which will indicate that the crane is in motion. A siren or electric horn pitched to a tone above or below the general noise level of operations is preferable to a gong or bell.

11.7 The crane operator shall take signals only from the designated hook tenders or riggers and no others. Hook tenders shall be identified by special hats or arm bands.

11.8 All loads shall be lifted or lowered under power.

11.9 Employees shall not be permitted to pass between the leading and trailing trucks of whirley cranes AT ANY TIME.

a. Wheel covers shall be provided which will protect all wheels of whirley, gantry, hammerhead and bridge cranes to a distance of ½ inch from the crane tracks.

11.10 Employees shall not remain under, or pass under crane loads.

11.11 Trolley lines for cranes shall be protected against accidental contact by man or material, by wood or other suitable sheathing, or if the trolley lines are elevated they shall have a vertical clearance of at least 12 feet above the ground.

a. Bumper guards for trolley ends of bridge cranes should be provided to prevent the hoisting cables from swinging into the trolley wires.

11.12 The crane operator shall be required to immediately notify a designated department head of any defects he notices in the crane or its equipment.

11.13 No person other than the crane operator, a trainee, the supervisor in charge of cranes, the crane inspector, repairmen on crane repair jobs or safety department men shall be permitted in crane cabs. No more than three persons shall be in the cab at any time.

a. Whenever possible, crane operators should be relieved on the ground and not in the crane cab.

11.14 Except under emergency conditions and then only with the approval of the safety department, men shall not ride loads. Men shall never be permitted to ride empty hooks or slings.

11.15 A clearance of at least 2 feet and preferably more shall be maintained between the crane and any stationary object or materials. Where existing structures make this clearance impossible, an exception to this rule may be granted by the United States Navy-Maritime Commission Safety Consultant after an inspection.

11.16 Strong-backs or spreaders should be used on all lifts where there is danger of the load buckling or where the spread is so wide slings or clamps may slip. Steel strong-backs are preferable to wood.

11.17 The hook tenders shall familiarize themselves with the weights of the various plates, shapes and sections handled, so chain or cable slings of the proper size will be used on lifts.

11.18 All chain and cable slings and strongbacks should be clearly marked, by color coding, to indicate the maximum safe load for which they are to be used.

11.19 All electric cranes should be equipped with limit switches to prevent double blocking.

11.20 Storage racks shall be provided for all chain and cable slings at points convenient to the operations so they may be safely stored when not in use. All chain and cable slings shall be inspected before each use by the hook tender and if found defective, shall be sent to the proper department for repair. Such inspections shall be in addition to, not substitutes for, the regular inspections by the safety department.

S-12. Plant Housekeeping.

12.1 Housekeeping shall be maintained at a high standard in all parts of the shipyard at all times. The following rules shall (or should, as indicated) be put into effect:

a. Wide, well-defined roads, aisles, and passages shall be laid out in the yard and shops and they shall be kept clear of obstructions and shall be kept clean and free from debris. The width of aisles and passages in some of the older yards may be limited because of exist-

ing structures, but an effort should be made to maintain a width of twice that of the widest hand or power truck, plus two feet.

12.12 Aisles and passages should be defined by white or yellow lines painted on the floors. Materials or machines should not be permitted to encroach on these lines into the aisle.

12.13 All staging platforms, ramps, stairways, walkways, or other walkway surfaces on shipways shall be kept clean of all debris such as welding rod tips, bolts, nuts, and similar material. Welding leads, burner hose and air hose should be elevated over or placed under the walkway surfaces or protected by cross-over planks. They should be neatly arranged and not left in coils or loops where they may cause men to trip and fall.

12.14 All deck areas on hulls shall be kept free of debris and construction material shall be neatly piled so as not to present a hazard to employees. (See par. S. 12.13 on hose, etc.)

12.15 All deck openings shall, as soon as practicable, be protected with guardrails at least 42 inches in height set 12" back from the edge of the opening. Manholes may be guarded by tacking three uprights to the deck and then tacking a ring of the proper diameter to the top of the uprights. Hatches, without coamings, may be guarded by tacking uprights to the deck at intervals of not more than 10 feet and fastening 2" x 6" or 2" x 8" timber rails in place at 42" from the deck. Midrails set 21" from the deck may be used also, and are especially recommended where women are employed.

(a) Where they are projecting stud bolts around the manholes or tank tops, they should be protected with either metal strips or wood covering to prevent slips and falls or snagging of clothing of workers.

12.16 All snow and ice shall be cleaned from stagings and platforms (by turning the planks), and from decks, before men on regular production are permitted to work on them.

12.17 Free access shall be maintained at all times to all exists and to all fire-alarm boxes or fire-extinguishing equipment.

12.18 All oils, paints, thinners, solvents, waste, rags, or other flammable substances shall be stored and used strictly

in accordance with the requirements of the National Fire Protection Association standards.

12.19 All staging lumber, or other lumber, when dismantled shall have all nails or spikes removed or bent over.

12.20 Plates and shapes shall be stored either in substantial metal or heavy timber racks or stored flat on a substantial timber or concrete foundation that will prevent shifting.

(a) Plates and shapes shall be stored so there is at least an 8-foot clearance from the center line of railroad tracks.

12.21 Angle brackets and similar small pieces shall be stored in racks.

S-13. Lighting.

13.1 A level of illumination should be maintained for the various type of jobs in all shops, at least as high as that recommended by the standards of the Illuminating Engineering Society.

Minimum Standards of illumination for certain industrial interiors as recommended by the Illuminating Engineering Society are as follows:

Type of Work	Minimum operating foot-candles—measured on the work
Assembly:	
Rough	10
Medium	20
Construction—Indoor:	
General	10
Forge shops and welding	10
Foundries:	
Charging floor, tumbling, cleaning, pouring and shaking out	5
Rough molding and core making	10
Fine molding and core making	20
Machine shops:	
Rough bench and machine work	10
Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing and polishing	20
Paint shops:	
Dipping, simple spraying, firing	10
Rubbing, ordinary hand painting and finishing; art, stencil and special spraying	20
Power plants, engine rooms, boilers:	
Boilers, coal and ash handling, storage battery rooms	5
Auxiliary equipment, oil switches and transformers	10
Engines, generators, blowers, compressors	15
Receiving and shipping	10
Sheet metal works:	
Miscellaneous machines, ordinary bench work	15
Punches, presses, shears, stamps, welders, spinning, medium bench work	20